Report
on
Sanitary Measures in India
in
1900-1901 to 1905-06

00134529

BOMBAY BRANCH

OF THE

ROYAL ASIATIC SOCIETY.

TOWN HALL, BOMBAY.

Digitized with financial assistance from

Government of Maharashtra

on 01 February, 2020

REPORT

ON

SANITARY MEASURES IN INDIA

IN

1900-1901.

L. 1905-06

LIBRARY OF THE BOMBAY BRANCH OF THE ROYAL ASIATIC SOCIETY

VOL. XXXIV.

Presented to both Houses of Parliament by Command of His Majesty.

134529

00134529

LONDON:
PRINTED FOR HIS MAJESTY'S STATIONERY OFFICE,
By DARLING & SON, Ltd., 34-40, Bacon Street, E.

And to be purchased, either directly or through any Bookseller, from
EYRE & SPOTTISWOODE, East Harding Street, Fleet Street, E.C.,
and 32, Abingdon Street, Westminster, S.W.;
or OLIVER & BOYD, Edinburgh;
or E. PONSONBY, 116, Grafton Street, Dublin.

1902.

[Cd. 1357.] *Price* 1*s.* 9*d.*

CONTENTS.

REPORT.

	PAGE
I. EUROPEAN ARMY:	
Sickness and mortality in 1900 ...	5
In Commands...	5
In Groups of Stations	6
Cholera	6
Small-pox	6
Fevers	6
Bowel complaints	7
Abscess of the liver	7
Plague	7
Venereal diseases	7
Invaliding	7
II. NATIVE ARMY:	
Sickness and mortality in 1900 ...	8
In Commands...	8
In Groups of Stations	9
III. GENERAL POPULATION:	
Vital Statistics	10
Bengal	10
North-Western Provinces and Oudh	12
Punjab...	12
Central Provinces	13
Burma	14
Assam	15
Madras...	15
Bombay	16
Berar	17
IV. JAILS:	
Sickness and mortality in 1900 ...	19
Bengal	19
North-Western Provinces and Oudh	20
Punjab...	20
Burma	20
Central Provinces	20
Assam	21
Madras...	21
Bombay	21
Berar	21
V. VACCINATION:	
General results	23
Bengal	23
North-Western Provinces and Oudh	24
Punjab...	24
Burma	24
Central Provinces	24

	PAGE
V. VACCINATION—*continued*:	
Assam	25
Madras...	25
Bombay	25
Berar	25
VI. MEDICAL INSTITUTIONS:	
Civil Hospitals and Dispensaries:	
Bengal	27
North-Western Provinces and Oudh	28
Punjab...	29
Burma	29
Central Provinces	29
Assam	30
Madras...	30
Bombay	30
Berar	31
Lunatic Asylums:	
Bengal	31
North-Western Provinces	31
Punjab...	32
Burma	32
Central Provinces	32
Assam	32
Madras...	32
Bombay	32
Medical Schools:	
Bengal	33
North-Western Provinces and Oudh	33
Punjab...	33
Madras...	34
Bombay	34
VII. SANITATION:	
Civil:	
Bengal	35
North-Western Provinces and Oudh	35
Punjab...	35
Burma	36
Central Provinces	36
Assam	36
Madras...	37
Bombay	37
Berar	38

11941—1500—11/1902 Wt 4593 D & S—6

ABSTRACTS.

	PAGE.
India Sanitary Report for 1900 :	
European troops	41
Native troops	57
Jails	64
General population	69
History of chief diseases (including plague)	86
Vaccination	104
Sanitary works	112
General remarks	117
Madras Sanitary Report for 1900 :	
General population	132
Chief diseases	134
Sanitary works	136
Personal proceedings and General remarks	137
Sanitary Engineering	141
Bombay Sanitary Report for 1900 :	
General population	142
Chief diseases (including plague)	147
Sanitary works	152
Personal proceedings and General remarks	152
Report of the Sanitary Board	155
Shipping and Health of the Port of Bombay	158
Calcutta Municipal Report for 1900–01	165
Calcutta Health Report for 1900	168
Madras Municipal Report for 1900–01	176
Bombay Municipal Report for 1900–01	184
Bombay Health Report for 1900	186

APPENDIX.

Memoranda by the Army Sanitary Commission on :—	
India Sanitary Report for 1900	189
Bengal Sanitary Report for 1900	192
North-Western Provinces and Oudh Sanitary Report for 1900	194
Punjab Sanitary Report for 1900	195
Burma Sanitary Report for 1900	197
Central Provinces Sanitary Report for 1900	198
Assam Sanitary Report for 1900	200
Madras Sanitary Report for 1900	202
Bombay Sanitary Report for 1900	203
Hyderabad Assigned Districts Sanitary Report for 1900	206
Calcutta Municipal Report for 1900–01	208
Madras Municipal Report for 1900–01	209
Bombay Municipal Report for 1900–01	211

A. GODLEY,
Under Secretary of State for India

INDIA OFFICE,
November, 1902.

REPORT.

The present Report on Sanitary Measures in India during the year 1900 is prepared for presentation to Parliament. It contains chapters on the health of the European and Native troops, on the health of prisoners in jails, and on the health of the general population ; it also contains chapters on vaccination, on medical institutions, including medical schools and lunatic asylums, and a chapter on sanitary works. Appended to the Report are abstracts of reports by the three principal Sanitary Commissioners in India, and memoranda by the Army Sanitary Commission in England reviewing the several Sanitary Reports for India.

I.—EUROPEAN ARMY.

Sickness and mortality in 1900.

There was less sickness among the European troops on service in India in 1900 than in the previous year, but the decrease was somewhat overweighed by an increase in mortality and invaliding. On an average strength of 60,553, the admissions into hospital were in the ratio of 1,143 per 1,000, against 1,149 in 1899, the daily sick-rate fell from 73 to 72, and the death-rate rose from 12·75 to 14·62. The invaliding ratio (33) was higher by 1 per 1,000, so that the total loss by death and invaliding was equal to 48 per 1,000, an increase of 3 per 1,000 on the previous year.

The following statement shows the relative extent of sickness and mortality among European troops in the four Commands during 1900 and the previous year :—

Commands.		Average Strength.	Ratio per 1,000 of Average Strength.				
			Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
Bengal	1900	18,956	1,075	70	13·40	33	46
	1899	21,278	1,191	81	13·82	36	50
Punjab	1900	16,562	1,085	65	12·62	27	40
	1899	18,080	1,085	62	14·82	24	39
Madras	1900	9,984	1,268	82	16·53	46	63
	1899	12,876	1,259	82	10·10	39	49
Bombay ...	1900	15,051	1,211	75	17·08	33	50
	1899	15,462	1,073	67	11·06	29	40
INDIA ...	1900	60,553	1,143	72	14·62	33	48
	1899	67,697	1,149	73	12·75	32	45

It will be seen from the above statement that Madras was the most unhealthy of the four Commands, Bombay coming next, and that both compare unfavourably with the previous year. In regard to mortality, there was an improvement in the Punjab and the Bengal Commands, their death-rates having fallen from 14·82 and 13·82 per 1,000 respectively to 12·62 and 13·40.

The chief causes of sickness in the whole European Army were, as in the year 1899, intermittent fever and venereal diseases, the former yielding a ratio of 308 per 1,000 against 235 in 1899, and the latter 298 per 1,000 against 313. More than a half (53 per cent.) of the total sickness resulted from these two causes. Enteric fever, as usual, was the chief cause of mortality, the death-rate from it being 4·77, which however is an improvement on 5·14, the ratio of the previous year. One-third of the total deaths was due to this cause.

Groups of stations.—The following table shows the sickness and mortality among the European troops according to groups :—

Groups.	Average Strength.	Ratio per 1,000 of Average Strength.		
		Admissions.	Daily Sick.	Deaths.
Burma Coast and Bay Islands	1,047	1,273	79	22·92
Burma Inland	1,723	1,672	101	15·67
Bengal and Orissa	2,153	1,356	75	19·97
Gangetic Plain and Chutia-Nagpur	5,748	1,057	70	12·87
Upper Sub-Himalayan	11,105	1,244	74	15·40
North-Western Frontier, Indus Valley, and North-Western Rajputana.	4,628	1,173	66	12·53
South-Eastern Rajputana, Central India, and Gujarat.	6,003	1,396	89	20·82
Deccan	9,358	1,160	74	16·99
Western Coast	1,491	781	53	14·76
Southern India	2,069	1,286	71	11·60
Hill Stations	8,874	726	53	8·45
Hill Convalescent Depôts and Sanitaria ...	3,247	1,127	79	14·78

Of the above 12 groups, seven returned a higher daily sick-rate than that for the European Army as a whole, and in eight groups the death-rate was greater. The most unhealthy groups, judged by the daily sick-rate, were Burma Inland and Central India, with daily sick-rates of 101 and 89 per 1,000 respectively.

Of the stations with a strength of over 1,000, the highest death-rates were those of Secunderabad (25·18), Meerut (18·73), Mhow (18·53), Poona (17·45), and Lucknow (17·16). In all these stations, except Lucknow, the mortality was higher than in 1899.

Cholera.—The mortality from cholera, which in 1899 had been the lowest on record, only one fatal case having been recorded, rose to 88 out of 107 cases. Nearly a fourth of the deaths occurred among the troops stationed at Secunderabad where the disease attacked all the corps in barracks except the Artillery.

Small-pox.—Among the whole of the European troops in India there were during the year under notice 36 cases of small-pox with three deaths. In the previous year there were 14 cases and one death.

Fevers.—From intermittent fever the admissions to hospital among the European troops in 1900 were in the ratio of 308 per 1,000 of strength, against 235 in the previous year. The death-rate was also higher, viz., 0·66 per 1,000, against 0·28 in 1899.

From enteric fever the admissions fell from 1,392 or 20·6 per 1,000 of strength to 970 or 16·0, and the deaths from 348 or 5·14 per 1,000 to 289 or 4·77. The decrease is attributed chiefly to "the almost complete absence of drafts from England and the freedom from field service." Of the four Commands, Bombay recorded the highest mortality under this head, viz., 6·71, followed by Madras 4·71, Punjab 4·35, and Bengal 3·64. Among the larger stations with an average strength of over 1,000, Quetta returned a death-rate from this fever of 11·40, Peshawar 10·06, Secunderabad 9·83, Meerut 7·49, Lucknow 7·35, Poona 7·35, Belgam 5·99, Rawalpindi 4·40, Agra 4·13, and Umballa 4·08. As usual, young and unacclimatised soldiers were the chief sufferers; among those from 20 to 25 years of age the death-rate was 6·85 per 1,000 against 7·55 in 1899, while among men between 25 and 30, and from 30 to 35, the mortality was 3·65 and 2·01 per 1,000 respectively. Among men of less than one year's residence in India the death-rate from this fever was 7·95 per 1,000, among men between one and two years 9·20, and among men between five and ten years' service 3·15 per 1,000. Of the total 289 deaths from enteric fever, 61 per cent. occurred among men between the ages of 20–25, and 31 per cent. among men of less than two years' residence in India.

Bowel Complaints.—The admissions from dysentery and diarrhœa among the European troops were in the ratio of 44 per 1,000 of strength, or 1 per 1,000 more than in 1899. The mortality from dysentery was in the ratio of 0·86 against 0·65 in the previous year, and from diarrhœa 0·05 against *nil.* Dysentery was most prevalent, as usual, in the Bengal-Orissa group, but it was more prevalent in the Madras and Bombay Commands than in that of Bengal.

Abscess of the Liver.—From abscess of the liver there were 94 deaths, yielding a ratio of 1·57 per 1,000 of strength, against 85 or 1·26 in 1899.

Plague.—There were six cases of plague among the European troops, and one death, against seven cases and two deaths in 1899.

Venereal Diseases.—Venereal diseases ranked second in the list of causes of admission to hospital, and first in the causes of invaliding. They were the cause of 26 per cent. of the total sickness during 1900, and of over 18 per cent. of the invaliding of the European Army of India. The admission-rate from venereal diseases per 1,000 of strength was 298·1 against 313·4 in 1899, being 224 per 1,000 less than the maximum rate (522·3) recorded in 1895. "So far," the Army Sanitary Commission remark, "the measures adopted during recent years with the object of lessening the disastrous effects of this scourge have been productive of marked benefit; but the returns show that there is ample room for further reduction of the numbers rendered inefficient by it." The Madras Command returned the highest rate, viz., 354·4 per 1,000 against 397·8 in 1899. Bombay came next with a ratio of 327·0 against 273·6, Bengal with 299·9 against 364·0, and the Punjab with 235·8 against 226·7. The number of men constantly sick in hospital from these diseases was 1,630, against 1,851 in the previous year; and the average stay of a case in hospital was about 33 days. The deaths from these diseases numbered 14, and the invalidings 380, against 14 and 440 respectively in 1899.

Invaliding.—The loss to the whole army by invaliding during 1900 amounted to 2,026 men, equal to 33·46 per 1,000, against 2,142 or 31·64 in 1899. The proportion of invalids to strength was highest in the Madras Command (45·77), followed by Bengal (32·97), Bombay (32·82), and Punjab (27·17). As regards the influence of age and length of residence in India upon invaliding, 52 per cent. of the total number invalided were under 25 years of age, against 59 in 1899, while 33 per cent. against 38 were of less than two years' service, and 72 per cent. against 81 were of less than five years' service. In the European Army of India as a whole 69 per cent. of the total strength had seen less than five years' service.

II.—NATIVE ARMY.

Sickness and Mortality in 1900.—The health of the Native Army of India was also not so good as in 1899.

The ratios of sickness and mortality among Native troops in the five Commands during 1900 and the previous year are given in the following table :—

Commands.		Average Strength.	Ratio per 1,000 of Average Strength.		
			Admissions.	Daily Sick.	Deaths.
Bengal	1900	26,582	717	31	10·46
	1899	26,820	716	29	10·03
Punjab	1900	42,311	796	28	14·72
	1899	44,224	731	27	12·48
Madras	1900	20,407	690	30	12·69
	1899	23,255	672	30	9·03
Bombay	1900	24,908	957	35	18·71
	1899	26,657	699	26	10·69
Hyderabad Contingent	1900	6,260	561	22	12·62
	1899	6,556	430	15	6·86
INDIA	1900	123,463	785	30	14·04
	1899	128,529	705	28	10·70

Of the five Commands, Bombay was the most unhealthy in 1900, returning a death-rate of 18·71 per 1,000, against 10·69 in the previous year ; the Punjab returned the next highest mortality of 14·72. Pneumonia was very prevalent in these two Commands, and the death-rates from it were 4·38 and 4·30 per 1,000 respectively.

The chief cause of sickness in the Native Army was ague, which caused 41 per cent. of the total admissions. Among the diseases from which the admissions to hospital were higher than in 1899 were cholera, enteric fever, ague, dysentery, diarrhœa, small-pox, and venereal diseases ; while from influenza and respiratory diseases there was a decrease in the admissions. From cholera the admission-rate rose from 1 per 1,000 of average strength in 1899 to 5·2, and from venereal diseases the admission-rate rose from 34·1 to 42·5, as compared with 298·1 per 1,000 among European troops. There were 9 deaths and 129 invalidings from venereal disease, against 14 deaths and 380 invalidings among European troops.

Pneumonia and cholera were the chief causes of death in the Native Army, and no less than 46 per cent. of the total deaths were due to them. The death-rate from pneumonia was 3·32 per 1,000 of average strength, against 3·86 in 1899. From this disease the mortality among the Native soldiers was more than eight times as great as that among European troops (0·40 per 1,000). Fevers of all kinds were the cause of 16 per cent. of the total deaths, against 39 per cent. among the European troops. From ague, remittent and simple continued fevers, the deaths among the Native troops were in the ratio of 2·09 per 1,000, while among the European troops the proportion was 0·86. On the other hand, the death-rate from enteric fever among the Native troops was only 0·15 per 1,000, as compared with 4·77 among the European troops.

From cholera there were 390 deaths in the Native Army, equal to 3·16 per 1,000 of strength, as compared with 68 or 0·53 in 1899.

During 1900 there were 56 cases of plague among the Native troops with 29 deaths, against 76 cases and 45 deaths in 1899.

Groups of stations.—The following statement gives the principal statistics of the Native Army, arranged in geographical groups, for 1900 :—

Groups.	Average Strength.	Ratio per 1,000 of Average Strength.		
		Admissions.	Daily Sick.	Deaths.
Burma Coast and Bay Islands	1,406	785	31	14·22
Burma, Inland	4,123	1,038	34	4·12
Assam	1,498	714	38	7·34
Bengal and Orissa	2,565	1,157	45	14·42
Gangetic Plain and Chutia-Nagpur	5,658	716	31	7·78
Upper Sub-Himalayan	15,326	676	26	8·55
North-Western Frontier, Indus Valley, and North-Western Rajputana.	15,861	928	32	21·37
South-Eastern Rajputana, Central India, and Gujarat.	11,169	1,017	38	21·04
Deccan	17,670	717	28	13·75
Western Coast	2,435	702	32	25·05
Southern India	6,764	652	33	14·04
Hill Stations	19,885	836	34	15·39

In ten of the 12 groups the daily sick-rate was higher than that for the whole Native Army, and in six the mortality was greater. The highest mortality was recorded by the Western Coast group, viz., 25·05, of which dysentery and diarrhœa contributed 6·57. In 1899 this group returned a death-rate of 9·98.

Of the large stations with a strength of over 1,000, the following recorded the highest death-rates :—Kohat 49·23, Bombay 39·71, Edwardesabad 31·27, Secunderabad 27·78, and Abbottabad 22·02. All these five stations returned high death-rates from cholera.

III.—GENERAL POPULATION.

The year 1900 was not a healthy one. The weather was hot and rather dry, with an approximately normal rainfall. Famine prevailed in several provinces, and all the chief diseases were unusually active. On the whole the health of the general population was bad. The returns of the year having been tabulated before the recent census, the birth and death-rates are calculated on the census figures of 1891.

Vital statistics.

Births were registered throughout all the 10 provinces in India in 1900, and the birth-rates varied between 41·1 and 26·2 per 1,000 of population under registration. All the provinces, except Madras, Lower Burma and Coorg, returned a lower birth-rate than in 1899, the falling off being attributed chiefly to scarcity and high prices and epidemic disease. The highest rates were recorded in the Punjab, the North-Western Provinces and Oudh, Bengal, Lower Burma and Assam, their respective rates being 41·1, 40·3, 38·6, 38·3, and 34·9. In the remaining provinces the birth-rates ranged between 31·9 in the Central Provinces and 26·2 in Coorg. The birth-rates exceeded the death-rates in five out of the ten provinces, the excess per 1,000 varying between 11·0 in Lower Burma and 2·0 in Bengal. The recorded deaths rose from 6,418,409 or 29·95 per 1,000 of registered population in 1899 to 8,322,584 or 38·1. Compared with 1899 the increase in mortality in 1900 was due to the greater prevalence of all the chief diseases. In all the provinces except Assam and the North-Western Provinces and Oudh the mortality was higher than in the previous year. Cholera was exceptionally prevalent during 1900, and the deaths rose from 169,236 to 804,378, the highest number on record. The increase was spread over all the provinces, but the chief sufferers were Bombay, the Central Provinces, Berar, Bengal and Assam, whose death-rates from cholera were 8·71, 7·14, 6·4, 4·86, and 4·51 respectively. The rise in the deaths from fevers by three-quarters of a million (774,691) was spread over all the provinces, except North Western Provinces and Oudh, Lower Burma and Assam. Plague was not so prevalent as in the two previous years, and the deaths fell from 139,000 in 1899 to 92,807. The decrease was principally in Bombay. Assam and Coorg continued to remain unaffected.

The deaths from the chief diseases and from all causes in the several provinces were as follow :—

	Cholera.		Small-pox.		Fevers.		Dysentery and Diarrhœa.		Deaths from all Causes.		
	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000 of Population under registration.	
										1900.	1899.
Bengal	345,878	4·86	20,620	0·29	1,703,804	23·97	64,664	0·91	2,603,736	36·63	31·21
North-Western Provinces and Oudh.	84,960	1·81	1,410	0·03	1,106,030	23·58	30,652	0·65	1,460,139	31·13	33·19
Punjab	28,260	1·37	10,425	0·51	685,895	33·37	25,913	1·26	980,211	47·69	29·57
Central Provinces	75,112	7·14	8,021	0·76	303,370	28·82	58,474	5·55	608,691	57·82	27·65
Lower Burma	3,440	0·77	3,014	0·68	49,888	11·18	8,217	1·84	122,714	27·51	27·30
Upper Burma	41	0·02	2,789	1·14	19,875	8·10	1,104	0·45	53,496	21·80	21·03
Coorg	—	—	314	1·81	4,840	27·97	206	1·19	6,302	36·42	28·00
Assam	23,761	4·51	975	0·18	77,557	14·70	14,996	2·84	161,631	30·64	31·01
Madras	60,662	1·8	27,692	0·8	288,521	8·8	38,858	1·2	770,859	23·4	20·1
Bombay	163,889	8·71	9,885	0·52	543,319	28·87	218,243	11·59	1,318,783	70·07	35·72
Berar	18,375	6·4	830	0·3	84,017	29·5	63,660	22·4	236,022	82·7	39·9
Total	804,378	3·73	85,975	0·39	4,867,116	22·56	525,187	2·43	8,322,584	38·1	29·95

Bengal.

The year was an unhealthy one in Bengal, and prices of food grains were high. The number of births registered in the province fell from 3,053,178 or 42·96 per 1,000 of population in 1899 to 2,749,582 or 38·68, the latter being made up of district rates varying from 49·19 in Noakhali and 46·83 in Tippera to 28·53 in Hooghly and 15·8 in Calcutta. Of the 46 districts there was a decrease of births in all except six, the greatest decrease being in Palamau, where the ratio was 15·51 per 1,000 below that of the

previous year. This district recorded the highest birth-rate in 1899 (53·28). Eighteen districts returned a birth-rate of over 40 and 26 of over 30 per 1,000, the highest, as already stated, being 49·19 in Noakhali. Calcutta returned the lowest birth-rate, and, as usual, compared unfavourably in this respect with other towns, its birth-rate being lower by 11·85 than the average of other urban areas.

Eleven towns returned a birth-rate in excess of 40 per 1,000, while 107 rural areas recorded rates of over 45 per 1,000. These figures are considerably below those of the previous year.

The total number of deaths registered during the year under notice was 2,603,736 or 36·63 per 1,000, as compared with 2,218,243 or 31·21 in 1899. There was thus an excess of births over deaths of only 145,846 or 2 per 1,000, against nearly 12 per 1,000 in the previous year. The district death-rates ranged from 55·66 in Purnea to 21·28 in Manbhum. In both urban and rural areas there was a marked increase in mortality, the rate of the former having risen from 33·10 to 43·46, and in the latter from 31·11 to 36·28.

From all the principal diseases the mortality was higher than in 1899. Cholera prevailed with greater severity, and the death-rate was the highest on record. The deaths rose from 107,678 or 1·51 per 1,000 to 345,878 or 4·86. No district entirely escaped the disease, and it attacked 33,142 villages against 17,217 in the previous year. Of individual districts the mortality was highest in Purnea (23·77 per 1,000), followed by Champaran (11·74), and in 19 others the rates ranged from 8·48 to 40 per 1,000. The excessive prevalence of the disease is attributed to the early cessation of the rains in the previous year and the lateness of the monsoon in 1900. As regards the seasonal incidence of the disease, the mortality was highest in the second quarter of the year and lowest in the first.

A large number of anti-cholera inoculations were performed during the year with remarkable success. Out of 873 coolie emigrants who were inoculated in the Purulia coolie depôt in Goalundo and were subsequently exposed to the contagion of the epidemic, only two were attacked ; while out of 1,527 uninoculated coolies 32 or 2·09 per cent. got cholera.

Deaths from small-pox rose from 13,116 or 0·18 per 1,000 in 1899 to 20,620 or 0·29 in 1900. The disease was present in all the districts, and compared with the previous year the mortality was higher in 30, lower in 13, and equal in three districts. The only districts in which it can be said to have prevailed in an epidemic form are Cuttack, Puri, Calcutta, and Palamau, with death-rates of 3·98, 2·46, 1·48 and 1·33 respectively. In no other district did the death-rate under this head reach 1 per 1,000.

Nearly 66 per cent. of the total deaths were recorded under fever. The number of deaths reported to have occurred under this head during the year was 1,703,804 or 23·97 per 1,000 of population, against 1,607,279 or 22·61 in 1899. Out of the 46 districts, 22 recorded a higher fever mortality than the provincial rate, twelve registering a rate of over 30 per 1,000. Dinajpur ranked first with a rate of 40·41, followed by Jalpaiguri 39·0, Faridpur 36·66, and Malda 36·14. Notwithstanding the high fever mortality, there was no corresponding increase in the sale of quinine, but, on the contrary, a slight decrease. In the previous year there was an increase of 8,423 on the number of packets sold in 1898.

Dysentery and diarrhœa prevailed with increasing severity throughout the year, 64,664 deaths having been registered, equal to 0·91 per 1,000 of population, against 41,334 or 0·58 in the previous year. The incidence of these diseases was higher than that of the preceding year in 43 districts out of 46. Darjeeling, which in 1899 occupied the third place, with a ratio of 3·11 per 1,000, headed the list with more than double that rate, viz., 6·33, followed by Calcutta 6·05, Patna 5·90, Howrah 4·96, Puri 4·85, and Cuttack 3·18.

Plague was present in the province throughout the year, and the total mortality recorded from it was 38,412, against 3,264 in 1899. The increase was greatest in the districts of Patna, Saran, and Gaya, the first of these recording 22,574 deaths. It is reported that disinfection of huts, houses, and clothing was largely resorted to in plague infected areas, and that in many instances people were induced to vacate their houses and camp out on new sites in the open—in some places this was done spontaneously.

In the municipality of Calcutta the birth-rate fell from 16·14 in 1899 to 12·7. The registered deaths numbered 36,709 or 43·5 per 1,000 of population, against 25,823 or 37·8 in the previous year. There was an increase in mortality under all the chief death causes. Cholera deaths rose from 990 to 2,754, small-pox deaths from 62 to 1,010, and deaths ascribed to fever from 7,173 or 10·5 per 1,000 to 7,642 or 11·21. From plague 8,354 deaths were registered in the city, against 2,681 in 1899.

North-Western Provinces and Oudh.

In the North-Western Provinces and Oudh the year 1900 was a healthy one, the birth-rate being considerably above the average, though lower than the exceptionally high rate of the previous year; and the death-rate was below the quinquennial mean. During the year 1,892,169 births were recorded, being equal to 40·34 per 1,000, against 2,255,627 or 48·09 in the previous year, which was the highest on record, the rate previously highest being 43·77 in 1884. Of the total 48 districts, 25 showed a birth-rate above and 23 below the average of the provinces. Bulandshahr again headed the districts with a birth-rate of 52·89, followed by Etah 52·34, Budaun 49·82, Farukhabad 49·28, Muzaffarnagar 48·57, and Bareilly 48·20. The birth-rate in municipalities was 41·26, against 47·24 in the previous year, and was made up of extremes ranging from 60·82 in Kandhla to 16·51 in Mussoorie.

The number of deaths registered was 1,460,139 or 31·13 per 1,000 of population, against 1,556,824 or 33·19 in 1899. The provincial death-rate, which was made up of district rates ranging from 45·40 in Sultanpur to 22·37 in Banda, was exceeded in 22 districts. The urban death-rate was 42·13, against 39·04 in 1899. Out of 104 municipalities, 41 recorded more deaths than births. Registration was again tested by local authorities, and the results disclosed an omission of 2·31 per cent. on 287,245 births, and 1·71 on 225,245 deaths; and in cases tested by the Vaccination Department, the omitted percentages were 0·51 of births and 0·31 of deaths.

Cholera was more prevalent than in 1899, and the mortality was the highest recorded since 1894. The total deaths from the disease numbered 84,960 or 1·81 per 1,000, against 8,142 or 0·17 in 1899. Sultanpur recorded the highest district rate of 15·96, followed by Bareilly 5·24, Rae Bareli 4·46, Ballia 4·26, and in five other districts the rates exceeded 3 per 1,000. Two districts, Almora and Hamirpur, were entirely free from the disease, and no outbreak occurred at any of the large fairs. Out of a total of 107,239 villages 7,465 were visited by cholera. The mortality was lightest in February (15 deaths), and heaviest in June (14,846). In noting the absence of epidemic disease at the great fairs, the Sanitary Commissioner, Lieutenant-Colonel Thomson, I.M.S., observes: "In past years these large gatherings were constantly the origin of widespread sickness and death. It is difficult to attribute the immunity from such outbreaks in recent years to anything but improved and systematic sanitary measures."

The absence of small-pox was even more marked than in 1899, the mortality having fallen from 2,096 or 0·04 to 1,410 or 0·03, which is the lowest rate recorded since 1871, when trustworthy registration began. No high death-rates were reported in the districts, of which four escaped the disease altogether. Aligarh headed the districts with a death-rate of 0·45, but except in this area the number of deaths did not exceed 100 in any district.

The mortality from fever in 1900 was lower than in the previous year, the number of deaths having fallen from 1,245,260 or 26·55 per 1,000 to 1,106,030 or 23·58. Among the districts, Bulandshahr came first with a fever death-rate of 38·51, followed by Muttra 36·40, Muzaffarnagar 33·53, Mainpuri 32·75, Meerut 32·73, Aligarh 32·03, Naini Tal 31·60, and 16 other districts recorded ratios above the provincial rate. The mortality reached its maximum in October, and the minimum was in February. In addition to the sale of quinine at a low price by postal agency, the experiment of selling it through landholders and other non-official agency was tried in four districts, and seemed likely to be successful.

The deaths from dysentery and diarrhœa rose from 27,206 or 0·58 per 1,000 in 1899 to 30,652 or 0·65. Among districts, Garhwal again recorded the highest ratio, viz., 7·68, followed by Almora 4·31, Dehra Dun 3·47, Benares 2·34, and Jhansi 2·16, the first four standing in the same order as in the previous year.

There was very little plague in the provinces during the year, only 135 deaths having occurred. In the previous year only seven deaths were reported in the provinces.

Punjab

The year 1900 in the Punjab was unhealthy. The province suffered severely from famine, and cholera and malarial fever were very prevalent. The number of births registered was 843,970 or 41·1 per 1,000 of population, as compared with 994,001 or 48·4 in 1899. Notwithstanding this great decrease, the birth-rate was higher than that of any other province in India, and was made up of district ratios ranging from 77·7 in Jhang to 21·7 in Simla. In 14 districts the provincial birth-rate was exceeded. The decrease in the birth-rate was very considerable in the famine affected districts of Hissar, Rohtak, Gurgaon, Karnal, Jhelum, Shahpur, and Ferozepore. The provincial birth-rate was lower than the death-rate by 6 per 1,000 of population; in one district (Hissar) the excess of deaths over births was nearly 72 per 1,000; and in eight other districts the increase of deaths over births ranged between 44 and 10 per 1,000.

From all causes 980,211 deaths were registered, giving a death-rate of 47·69, against 607,725 or 29·57 in 1899. The highest district rates were reported from Hissar 96·4, Ferozepore 86·8, Karnal 73·7, Rohtak 68·0, and in 11 other districts the death-rates ranged from 61·5 to 40·8.

The province suffered severely from cholera during the year, and the total number of deaths registered from the disease was 28,260 or 1·37 per 1,000 of population, against only 33 deaths in 1899. More than half the deaths were contributed by the famine affected districts of Hissar, Rohtak, Karnal, Ferozepore, and Lahore, and the first of these districts contributed no less than 23 per cent. of the total cholera deaths. One district (Simla) was entirely free from the disease, and in another (Kangra) only one death was recorded. Only 634 cholera deaths occurred during the first three months of the year. In April there were 1,888 fatal cases, and the maximum number of 9,711 was registered in July. In each of the following five months there was a decrease in the mortality, December recording only 17 deaths. The disease was confined to 2,551 villages out of a total of 38,548.

Small-pox was more than usually prevalent, causing a mortality of 10,425 and a death-rate of 0·51, against 5,149 or 0·25 in 1899. All the districts were affected, but the disease was severe only in five., viz., Gurgaon with a death-rate of 2·45, Hissar 1·68, Peshawar 1·48, Montgomery 1·22, and Jhang 1·02. Of the total 10,425 deaths from this disease, 2,728 occurred among children under one year, and 6,457 among children over one and under ten years of age.

The mortality from fevers was greatly in excess of that recorded in 1899, and was equal to 70 per cent. of total deaths from all causes. The deaths numbered 685,895 or 33·37 per 1,000, against 388,689 or 18·57 in 1899. The provincial rate was exceeded by nine out of the total 31 districts, the highest being Hissar 70·02, Ferozepore 69·36. Karnal 55·39, and Rohtak 51·23. In five other districts the provincial death-rate from fevers was exceeded.

From dysentery and diarrhœa the deaths numbered 25,913 or 1·26 per 1,000 against 15,747 or 0·77 in 1899. The increase was general throughout the province; it occurred with few exceptions in every district. It was most marked in the famine affected districts, particularly Hissar, which recorded a death-rate from these diseases of 3·64 against an average of 1·06 for the five previous years.

Plague was present in the province during the year, and 495 deaths were recorded, against 255 in the previous year. Only three districts were affected, viz., Jullundur, Hoshiarpur, and Gurdaspur, but the disease was again chiefly confined to Jullundur.

Central Provinces.

The year 1900 was the most unhealthy one the Central Provinces have experienced for twenty years, except the famine year of 1897. Pestilence and famine had to be encountered, and resulted in a low birth-rate and an unusually high death-rate. A total of 335,436 births was registered, being equal to 31·87 per 1,000 of population, against 497,419 or 47·35 in 1899. The falling off was general, the decrease varying from 1,851 in Burhanpur to 27,321 in Raipur; and in only four districts was there an excess of births over deaths. By districts the birth-rates ranged from 43·74 in Nimar to 25·55 in Bilaspur. The provincial birth-rate was exceeded in fifteen districts.

The deaths during the year numbered 608,691 or 57·82 per 1,000, against 291,054 or 27·65 in 1899 and 658,822 in 1897. "In face of the undoubted fact," the Sanitary Commissioner states "that in 1897 the actual physical conditions were much less severe in extent and degree than in 1900 the only explanation I can offer of the comparatively low death-rate on the latter occasion is that it was due to relief measures having been then instituted at an earlier date, before the general health of the people had much deteriorated, and to their having been subsequently carried out on a more liberal scale and under better organization and supervision." The provincial death-rate was exceeded in nine districts, with ratios varying between 110·82 in Nimar and 61·21 in Bhandara. With the exception of Mandla district there was a rise in the mortality in every other part of the provinces.

Cholera was unusually severe and extensive, 75,112 deaths having been recorded or 7·14 per 1,000 of population, against only 76 deaths in 1899. The year commenced with 162 deaths in January, and the disease increased in fatality until June, when the deaths went up to 23,027. Then followed a decline, and only 5 deaths occurred in November, when the epidemic finally disappeared.

Small-pox was much more prevalent than in the previous year, and the deaths rose from 1,511 or 0·14 per 1,000 in 1899 to 8,021 or 0·76. The disease affected every district but one (Mandla), but only in four districts did the death-rate exceed 1 per 1,000, Sambalpur ranking highest with 3·52. Of the total small-pox deaths 2,026 occurred among infants and 2,671 among children between one and 10 years of age.

Fever claimed more victims than all the other diseases put together, the deaths numbering 303,370 or 28·82 per 1,000 of population, against 168,326 or 15·98 in 1899. But there is reason to suspect that many deaths other than fever were recorded under that head, as, it is observed, "whenever a death occurs from causes which the villager does not clearly understand, it is set down to fever." The provincial death-rate from fever was exceeded by eight districts, with ratios ranging from 75·21 in Nimar to 30·43 in Sambalpur.

From dysentery and diarrhœa the registered mortality rose from 13,489 or 1·28 per 1,000 of population in 1899 to 58,474 or 5·55. The lowest death-rate under this head was again recorded by Bhandara district (0·95), Mandla coming next with (0·96); while the highest death-rate from these causes was registered by Sambalpur (16·86), Wardha following (15·62), Betul 14·50, Chandla 10·72, and Chhindwara (10·14).

During the year there were 590 deaths from plague against 584 in 1899. Only seven of the deaths were imported cases, the rest being indigenous. The disease did not succeed in establishing any firm hold in the provinces, as all the deaths among indigenous cases occurred in the Nagpur district. It speaks well for the precautions taken to prevent the disease spreading in these provinces, "lying as they do in the very pathway of and surrounded by infection."

Burma.

In Burma some slight improvement was made in the registration of vital statistics. Births and deaths continued to be recorded in Lower Burma and registration has now been extended to 13 municipal towns in Upper Burma. In the area under registration in Lower Burma 171,183 births were recorded in 1900, giving a birth-rate of 38·37 per 1,000 of population, as compared with 165,229 or 37·04 in 1899. The district rates ranged from 48·17 in Sandoway to 17·43 in Rangoon. The number of deaths registered was 122,714, representing a death-rate of 27·51 per 1,000 of population, against 121,771 or 27·30 in 1899. By districts the death-rates ranged from 19·59 in Prome to 42·39 in Rangoon.

In Upper Burma 11,489 births were registered during the year among a population of 311,605, the birth-rate being 36·87. The registration of deaths extended to a population of 2,454,288, and among them there were 53,496 deaths equal to 21·80 per 1,000. The results obtained, it is remarked, "are sufficiently encouraging, and when a somewhat longer trial has been made, the extension of the system may be found possible."

None of the chief diseases was unusually prevalent during the year. Cholera prevailed in Lower Burma throughout each month of the year and caused 3,440 deaths or 0·77 per 1,000 of population, against 4,942 or 1·11 in 1899. All the districts were visited by the disease, but Toungoo and Sandoway had only one death each, and in five other districts the mortality was small. Thongwa suffered more than any other district, and recorded a cholera mortality of 2·75 per 1,000, followed by Mergui with 2·38 and Myaungmya with 2·28. Six per cent of the 16,757 villages were affected, against 7 per cent in 1899. The months of greatest mortality were February, March, and April. In Upper Burma there were only 41 cholera deaths, and 37 of these occurred in the first quarter of the year.

Small-pox was much less fatal than in 1899, the deaths having fallen from 5,891 or 1·32 per 1,000 to 3,014 or 0·68. Of the 3,014 deaths, 476 or 15·8 per cent. were infants and 1,470 or nearly 49 per cent. were children over one and under 10 years of age. The Irrawaddy division suffered most, its four districts returning 1,270 deaths. In 1899 the Pegu division was the chief sufferer from this disease with 3,013 deaths; but in 1900 the mortality fell to 604. No district was free from small-pox during the year, but only one death was returned by Toungoo. Under this head Upper Burma recorded 2,789 deaths or 1·14 per 1,000 of population under registration.

Deaths ascribed to fever fell from 51,177 or 11·47 per 1,000 in 1899 to 49,888 or 11·18, which was made up of district rates ranging from 20·38 in Sandoway to 5·84 in Amherst. In nine other districts the provincial rate was exceeded. The town death-rate from fever was 8·13, and the rural rate 11·63, as compared with 8·12 and 11·97 respectively in 1899. In only six towns was the mortality above the average for the province, Pegu coming first with 23·88, followed by Myaungmya with 15·71, and Kawkareik with 14·85. The deaths from fever in Upper Burma numbered 19,875 or 8·10 per 1,000 of its population.

The deaths registered under dysentery and diarrhœa during the year aggregated 8,217, or 146 more than in 1899, the death-rates being 1·84 and 1·81 per 1,000, respectively. By districts the highest mortality under this head was recorded by Rangoon 5·16, followed by Thaton 3·72, Kyaukpya 3·71, and Myaungmya 3·15; in the remaining 14 districts the

death-rates ranged from 2·55 to 0·55. In Upper Burma 1,104 deaths were registered from these complaints, being equal to 0·45 per 1,000 of population.

Assam. Registration of vital statistics shows signs of improvement in Assam, but the number of births registered was nearly everywhere far below the estimated probable number. The total number of births registered during the year 1900 was 184,427, giving a ratio of 34·96 per 1,000 calculated on the population of 1901, as compared with 179,027 or 35·45 in 1899. The highest birth-rate was again recorded by Goalpara district, viz., 41·15, followed by Sylhet 39·86, and Cachar 35·20, these being the only three instances in which the provincial rate was exceeded, as the rates of the remaining districts ranged from 31·93 in Darrang to 25·44 in Lakhimpur.

The province was fairly healthy during the year, though the registered deaths rose from 156,595 or 31·01 per 1,000 of population in 1899 to 161,631 or 30·64 per 1,000. There were, however, marked differences between the death-rates of the several districts. The highest was recorded in Nowgong, viz., 53·03, followed by Darrang 44·09, and Goalpara 34·45 ; the remainder being below the provincial average. No districts except Nowgong, Cachar and Kamrup registered so high a death-rate as in the previous year. Taking the province as a whole an excess of births over deaths to the extent of 4·32 per 1,000 was reported, being identically the same as in the previous year.

Cholera was considerably more fatal than in 1899, the number of deaths having risen from 11,288 or 2·24 in 1899 to 23,761 or 4·51 per 1,000 of population. The increase was general, but was most marked in the districts of Nowgong, Darrang, and Kamrup, which recorded the unusually high ratios of 24·95, 9·60, and 7·35 respectively. This violent outbreak occurred during the hot weather, and it is reported that "although Nowgong has often been visited by epidemics of cholera, it never suffered before to such a severe extent." Among tea-garden coolies who travelled up the Brahmaputra Valley in steamers there were 177 deaths from cholera, against only 21 in 1899 ; and among the coolies at the depots, after landing, there where 351 deaths, against 51.

The mortality from small-pox again showed a considerable reduction, the deaths numbering only 975 or 0·18 per 1,000, against 1,565 or 0·31. "Last year," the Sanitary Commissioner writes, "I was able to report the disease as practically non-existent in the Surma Valley. Now I think I may fairly say it plays quite an insignificant part in producing mortality in any portion of the province, which speaks volumes for our vaccination work." Of the total 975 small-pox deaths, Sylhet contributed 531. Over 74 per cent. of the deaths occurred among children under 10 years of age.

There was a marked decrease in the mortality registered under fevers, including kala-azar, the number of deaths having fallen from 91,096 or 18·04 per 1,000 of the population in 1899 to 77,557 or 14·70. Of these 9,036 were from kala-azar against 14,246 in 1899. The provincial fever death-rate was exceeded by three districts, Goalpara ranking first with a rate of 28·02. As in previous years, the bulk of the kala-azar deaths occurred in Nowgong district, but there was again a marked improvement on the previous year's figures, the number of deaths having fallen from 8,192 to 4,661. In Darrang also the mortality under this head fell from 4,101 to 2,979. In his previous report the Sanitary Commissioner expressed the opinion that the epidemic of this disease might be said to be surely if slowly ceasing.

The registered number of deaths from dysentery and diarrhœa rose from 13,835 or 2·74 per 1,000 of population to 14,996 or 2·84. The district rates presented the same extraordinary and unaccountable differences as in former years. Thus in Goalpara the rate was 0·47, and in Kamrup and Nowgong 1·26 and 1·76 respectively, while in Lakhimpur, Darrang, and Sibsagar the rates were 6·11, 4·74, and 4·55 respectively. "I cannot understand," the Sanitary Commissioner remarks, "why the death-rate from acute bowel complaints should always be so much higher in the Sibsagar and Lakhimpur districts than elsewhere in the Assam and Surma Valley districts, and I am inviting the special attendance of the district Civil Surgeons to this anomaly."

Madras. The number of births registered in Madras Presidency during the year was 1,049,199 or 31·8 per 1,000, against 1,048,335 or 31·3 in 1899. The rates for urban and rural areas were 35·7 and 30·9, against 33·0 and 26·9 respectively in the previous year. Towards the close of the year the provisions of Madras Act III of 1899, under which registration of vital statistics is compulsory, were applied to 400 village communities, "and it is scarcely too much to hope," the Sanitary Commissioner with the Government of India remarks, "that surely, if slowly, a complete revolution in the character of the statistics

may be looked for." Considered by districts, the Madras district registered the highest ratio of 46·1, followed by Chingleput with 40·2 ; in thirteen other districts the rate was above 30 per 1,000 ; and in the remaining seven districts the rate was above 25 per 1,000 ; in all but eight of the 22 districts there was an increase in the birth-rate.

The mortality in 1900 was higher than that of the previous year by 95,765, the deaths having risen from 675,094 or 20·1 per 1,000 to 770,859 or 23·4. By districts, Madras City recorded the highest death-rate of 46·8, which is 7·5 per 1,000 higher than that registered in the previous year. In the other districts the mortality ratios ranged from 34·4 per 1,000 in Nilgiris to 16·4 in Ganjam. The Sanitary Commissioner (Dr. King) observed in his report for 1899 : "It is hopeless to attempt, under existing circumstances of registration, to criticise the death-rates reported from districts. They may possibly sink to the almost certainly ridiculous rate of 14·4 per 1,000 in Ganjam, or rise to nearly 30 per 1,000 in South Canara, without its being possible to state definitely what are the errors of omission and commission. The only criterion available is the approach to accuracy of the birth-rate, and the acknowledged existence of special diseases. One cause of deficient death-rate is certainly a tendency to ignore the deaths of infants below one year of age."

Of the chief diseases, the mortality from cholera was more than double that recorded in 1899, the number of deaths having risen from 29,082 or 0·9 per 1,000 to 60,662 or 1·8. All the districts were affected. The disease was most severe in Madura, Tanjore, Tinnevelly, and Godavari, which recorded cholera death-rates ranging between 4·7 and 3·0 per 1,000. In the remaining districts the rates varied from 2·6 in Cuddapah to 0·2 in Ganjam. The average death-rate in municipal and other towns from the disease was 2·8 per 1,000, against 1·5 in 1899, and that in rural tracts 1·8, against 0·8. Twenty of the municipalities were free from cholera, while three recorded death-rates over 10 per 1,000, viz., Perityakulam 20·0, Tinnevelly 13·8, and Palni 12·4.

The mortality from small-pox also increased, the deaths having risen from 16,991 or 0·5 per 1,000 in 1899 to 27,692 or 0·8. Of the districts, Godavari came first with a rate of 3·5, Tanjore 1·7, and South Arcot and Madura 1·2 each. Of the total small-pox deaths, 8,249 or 29·5 per cent. occurred amongst children under 1 year of age, and 7,269 or 26 per cent. among those between 1 and 10 years of age.

From fevers the registered deaths rose from 245,549 or 7·3 per 1,000 of population in 1899 to 288,521 or 8·8. Nine districts had death-rates of over 10 per 1,000, and seven of over 5 per 1,000. Six of the 59 municipal towns returned fever death-rates exceeding 10 per 1,000, the highest being 16·7 in Nandyal, 13·4 in Kurnool, and Kodaikanal 13·2. Among the lowest were Vaniyambadi 0·3, and Tirúpattur 1·5. Dr. King thinks the low rates are probably due to a large proportion of the deaths from fevers in these plague infected localities having been registered under "other causes" to avoid the enquiry as to the cause of death, consequent on a report of fever.

The number of deaths registered under dysentery and diarrhœa in the Presidency was 38,858 or 1·2 per 1,000, against 31,307 or 0·93 in 1899. Of the districts, Madras as usual came first with a death-rate from this cause of 7·7, against 7·9 in the previous year, followed by Chingleput with 3·3, Malabar 2·2, and South Canara 2·1 ; seven other districts had rates over 1 per 1,000. Of the towns, Tuticorin recorded the high death-rate of 10·7 per 1,000, followed by Palamcottah 10·2, Chingleput 9·5, Gudiyattam 9·4, and Guntur 9·4 ; in nine other towns the rate ranged between 8 and 6 per 1,000. The large mortality in these towns is attributed to defective conservancy or a contaminated water-supply, or to both.

Plague was imported into the Presidency towards the close of the year 1898, and eleven districts were more or less affected. Precautionary measures were promptly taken, and the spread of the disease was, as a rule, successfully prevented. By the end of the year 711 attacks with 557 deaths had been reported. In 1899 the attacks rose to 2,385 and the deaths to 1,843. In 1900 the cases fell to 895 and the deaths to 665.

Bombay.

The year 1900 was the most unhealthy in the recent history of the Bombay Presidency, and the vital statistics were affected to an enormous extent by the influence of widespread and very severe famine. Including Sind, 505,652 births were registered during the year, giving a birth-rate of 26·87 per 1,000 of population, the lowest for the past ten years, as compared with 685,348 or 36·42 in 1899. Bombay City, as usual, recorded the lowest rate, viz., 15·42, against 12·88 in the previous year, and Dharwar the highest, 36·24.

The total number of deaths registered in the Presidency rose from 672,269 in 1899 to 1,318,783, and the rate per 1,000 of population from 35·72 to 70·07, which was made up of district ratios ranging from 281·06 in Panch Mahals to 25·42 in Upper Sind Frontier.

The increase of 646,514 deaths was spread over all the districts except three, Belgaum, Dharwar and Kanara. Ahmedabad district recorded the second highest death-rate (173·03), followed by Broach with 163·82 and Kaira with 148·44. Ten other districts had a death-rate above 50 per 1,000. Distress was most severe in the Gujarat districts and the high mortality was greatly swollen by the tide of immigrants from adjacent Native States.

From cholera the deaths during the year rose from 8,579 or 0·46 per 1,000 in 1899 to 163,889 or 8·7, the epidemic being by far the most severe of any during the past 20 years. No district escaped the disease, and in ten of the 24 districts the mortality was over 10 per 1,000. The months of greatest prevalence were May, June and July, when 111,075 deaths occurred. Out of 220 rural circles only 18 enjoyed entire immunity from attack, and out of 56 town circles only five were free from the disease.

Small-pox was more fatal than in any of the previous ten years though the mortality was not great compared with most other provinces. The deaths rose from 1,946 in 1899 to 9,885, the death-rate being 0·52 per 1,000. No district was free from the disease, though some were but slightly visited, and only in four cases did the death-rate exceed 1 per 1,000, the highest rate recorded being 3·71 in Bombay City. Both in the City and in the adjacent districts the influx of starving immigrants from Native States materially contributed to swell the death-rate from small-pox. According to age, 28·86 per cent. of the small-pox deaths occurred among infants under one year of age, and 41·20 per cent. among children between the ages of 1 and 10.

Fever was responsible for more than half-a-million deaths, the number being 543,319 or 28·87 per thousand of population against 228,438 or 12·14 in 1899. These numbers do not include deaths from plague, from which there were 33,196 against 86,596 in 1899. The average fever death-rate was exceeded in seven districts, the mortality being especially high in the famine districts of Gujarat. The collectorate of Panch Mahals headed the list with the high ratio of 167·7 per 1,000, followed by Ahmedabad 111·27, but "the returns from these two districts," the Sanitary Commissioner says, "show serious defects in registration, and fever as a cause of death is much too frequently entered."

The number of deaths ascribed to dysentery and diarrhœa also rose from 74,736 or 3·97 per 1,000 of population in 1899 to 218,243 or 11·59, which is by far the highest ratio on record. In nine of the 24 districts the average death-rate under this head was exceeded, the highest being recorded by Panch Mahals 64·16, followed by Ahmednagar 27·26, Khandesh 26·19, Kaira 23·53, Sholapur 22·13, Broach 17·07, and Nasik 15·17.

From plague 33,196 deaths were reported during the year, giving a ratio of 1·76 per 1,000 of population, against 96,596 or 5·13 in 1899. The outbreak commenced in September of 1896, and at the end of that year 2,086 deaths had been reported, being equal to a ratio of 0·12 per 1,000. Up to the end of 1896 ten of the 24 districts had remained free of the disease, but in spite of precautions to check its progress, plague extended to all but two (Kanara and Panch Mahals) of the districts by the close of 1897, though some were but slightly affected. In 1898 all the districts were affected except three in Sind. Of the 33,196 deaths in 1900, Bombay City contributed 13,285, a decrease of 2,589 on the number reported in 1899, and the plague death-rate fell from 19·69 to 16·48. Poona district followed with a rate of 4·80, Belgaum 4·60, and Karachi 4·36. In six districts no deaths from plague were recorded in the year under notice. An interesting account of the further progress of the plague, and of the measures taken to suppress it, will be found in the Abstract of the Report of the Sanitary Commissioner with the Government of India, at pages 97–102.

Berar.

The year 1900 was exceptionally unhealthy in Berar, and the province suffered throughout the year from severe famine which lowered the vitality of the people and rendered them more susceptible to disease. The number of births registered fell from 144,034 or 50·5 per 1,000 of the population in 1899 to 89,302 or 31·3, which is the lowest birth-rate on record. The low rate was the result of famine and its accompaniments. In all the six districts of the province the birth-rates were much lower than in the previous year, and ranged from 34·2 in Wun to 26·9 in Buldana.

The deaths rose from 113,992 or 39·9 per 1,000 of population in 1899 to 236,022 or 82·7. All districts contributed to the increase, the excess being most marked in Basim, where the rate (110·8) was more than double that of 1899. The influx of moribund people from Hyderabad territory is said to have added greatly to the mortality in Berar. More than half the deaths (130,599) were either children under five (97,899) or old people (32,700) over 60 years of age; "in other words, the weakest suffered most, as might be expected in a famine."

An epidemic of cholera added to the evils of the year, and the recorded statistics show it to have been one of the severest during the last quarter of a century. The disease prevailed throughout the year and claimed 18,375 victims, giving a death-rate of 6·4 per 1,000 of population. In the previous year there were only 541 deaths from cholera. All the districts suffered, Basim most severely; about a third of the cholera deaths occurred in this district, the death-rate being 15·0 per 1,000.

Small-pox was more prevalent, and caused 830 deaths as compared with 305 in 1899, the death-rate being 0·3 per 1,000 against 0·1. More than a half of the deaths (488) occurred in Wun district, bordering on the Hyderabad State, from which a large number of unvaccinated people came, and the fewest number (14) in Ellichpur district. Nearly 58 per cent. of the deaths occurred amongst children under 10 years of age.

The deaths ascribed to fevers rose from 49,938 or 17·5 per 1,000 in 1899 to 84,017 or 29·5. The increase was general in all districts, the death-rate varying between 41·3 in Wun and 20·7 in Ellichpur. The Sanitary Commissioner (Dr. Swaine) writes: "Owing to the drought in 1899 fevers were not very prevalent at the end of that year and the beginning of 1900. As the year 1900 advanced influenza became prevalent, and deaths from it were registered under the head 'Fevers,' and the number of cases of fevers also gradually commenced to increase—mostly of the type of simple continued—due in all probability to the unwholesome water and food the people were consuming, their stamina being reduced, and also to exposure to the very intense heat in the hot weather and wet and damp in the rains."

The number of deaths attributed to dysentery and diarrhœa rose from 20,263 or 7·1 per 1,000 in the previous year to 63,860 or 22·4. Basim district recorded the highest mortality under this head, viz., 33·0, against 6·4 in the previous year, Buldana following with 28·6, which was nearly six times higher than the ratio (5·1) of the preceding year. The other district rates ranged from 24·4 in Akola to 9·2 in Wun. Bad food and bad water were the chief causes for the excessive mortality. Dr. Swaine states: "When the rains commenced bowel complaints increased owing not only to the inclemency of the weather but also to the consumption of green fresh vegetation with which the people supplemented their diet, and gorged themselves, in many cases with fatal results."

Two imported cases of plague were reported in the province during the year. Both were found at Khamgaon, one occurring in January and the other in December.

IV.—JAILS.

Sickness and mortality in 1900.

The health of the jail population of India during 1900 was bad. Famine and disease were prevalent and increased the number of prisoners. "The year was naturally an unfortunate one for the jail population. It was necessary to cope with suddenly enhanced demands on accommodation, and a large portion of the prisoners convicted in some provinces entered jail in a weaker condition than in a normal year."

The daily average sick per 1,000 of average strength rose from 31·4 in 1898 to 32·4, the ratio of admissions into hospital from 792 to 851, and the death-rate from 21·9 to 33·4. In every province except the North-Western Provinces and Oudh, Assam and Coorg, the jail death-rate was higher than in 1899. The most unhealthy administrations were Berar and the Central Provinces. There was a great increase of both morbidity and mortality from cholera among the prisoners. The disease appeared in jails of every province, the chief sufferers being the Central Provinces, Bombay, Berar, and Bengal. The total cases numbered 515, of which 286 were fatal, giving a death-rate of 2·5 per 1,000 of average strength against 3·7 amongst the general population.

The following statement shows the sickness and mortality among all classes of prisoners in the jails and subsidiary jails of the several provinces for 1900, as compared with the previous year :—

Provinces.	1899.			1900.		
	Ratio per 1,000 of Average Strength.			Ratio per 1,000 of Average Strength.		
	Admissions.	Daily Sick.	Deaths.	Admissions.	Daily Sick.	Deaths.
Bengal	1,034	34	23·4	1,173	39	40·3
North-Western Provinces and Oudh.	792	38	22·2	764	36	22·1
Punjab	1,107	33	18·8	1,239	38	23·6
Burma	384	27	18·7	555	28	21·2
Central Provinces	863	27	24·4	934	30	69·0
Assam	982	73	48·0	817	35	22·8
Coorg	815	29	126·7	628	24	54·6
Madras	411	22	16·9	412	23	25·4
Bombay	599	25	25·2	778	25	56·8
Berar	445	13	13·3	943	27	79·9
India	792	31	21·9	851	32	33·4

Bengal.

The health statistics of the Bengal jails for 1900 are unsatisfactory reading. The admissions into hospital were in the ratio of 1,173 per 1,000 of average strength, against 1,034 in 1899, the average daily sick-rate rose from 34 per 1,000 to 39, and the death-rate from 23·4 to 40·3. These results are the more unsatisfactory as the death-rate among the general population was less than the jail death-rate by over 3 per 1,000. Among all classes of prisoners there were 837 deaths, and of these 731 were convicts. The high death-rate in the jails was directly due to the poor condition of many of the prisoners when admitted, for while among prisoners who had been less than six months in jail the death-rate was 54·7 per 1,000, it was only 36 per 1,000 among those between six months and a year in jail. The prevalence of cholera was another cause of the high mortality. From this disease there were 78 deaths against only 3 in the previous year. Besides cholera, the diseases which contributed chiefly to the convict death-rate (39·6 per 1,000) were dysentery 180 deaths, respiratory diseases 130, pneumonia 79, and malarial fever 54. Out of 48 jails the death-rate among convicts exceeded 60 per 1,000 in 11, the highest being Daltonganj 234·5, Faridpur 91·3, Motihari 88·0, Chapra 86·9, Jalpaiguri 83·8, Barisal 73·5, and Hooghly 71·8. In the first three and the last of these there were severe epidemics of cholera, and the others are all situated in the most unhealthy districts in the province. In three jails there were no deaths.

North-Western Provinces and Oudh.

The sanitary history of the jails of the North-Western Provinces for 1900 is again satisfactory. Though the provinces were not free from epidemic disease, the health of the prisoners was fairly good, cholera, small-pox, and debility being the only diseases with increased mortality. The admissions into hospital fell from 792 per 1,000 of average strength in 1899 to 764, the daily average sick-rate from 38 to 36 per 1,000; the death-rate was 22·1, practically the same as in the previous year (22·1). Of the 55 jails in the province there were no deaths in one, and 23 others recorded death-rates below the provincial jail rate. The highest mortality (100·8) occurred, in Lalitpur, a fifth class jail with an average strength of 119, followed by Jhansi 65·4, Fatihpur 55·0, Banda 48·2, Bareilly 45·2, Cawnpore 40·9, and Mirzapur 40·0. The high death-rates in the Lalitpur and Jhansi jails were greatly due to the bad state of health of an exceptionally large number of the prisoners admitted, and to the transfer of most of the healthy prisoners to other jails, whilst the old, weak and sick were kept. Chief among the jails with a low mortality were Muzaffarnagar, with only one death on an average strength of 196, and Bara Banki with four deaths. Only six fatal cases of cholera were reported during the year. Of other diseases, dysentery was accountable for 132 deaths against 144 in 1899. From pneumonia there were 102 deaths against 121, from tubercle of the lungs 84, and from other respiratory diseases there were 18 deaths. Of the total 687 deaths 634 were of convicts, their death-rate being 22·0 per 1,000, against 21·8 in the previous year.

Punjab.

The health of the prison population of the Punjab was not so good as in 1899. The admissions to hospital per 1,000 of average strength rose from 1,107 in 1899 to 1,239, the daily sick-rate from 33 to 38, and the death-rate from 18·8 to 23·6. The death-rate of the free population was 47·69, more than twice as high as that of the jails. The predisposing causes of the high mortality among the jail population were the poor health of many of the prisoners on admission and the severe epidemic of malarial fever during the autumn months. Cholera made its appearance for the first time since 1892, but there were only 12 deaths from the disease, and nine of these occurred in Mung Rasul jail. The average death-rate was exceeded in 13 jails, the highest being 65·04 in Delhi, 56·34 in Karnal, 43·29 in Ferozepore, 40·16 in Jullundur, 39·47 in Dharmsala, 33·71 in Lahore Female jail, 30·61 in Abbottabad, and 30·06 in Ludhiana. In four jails there were no deaths. Of the total 363 deaths, all but 33 were of convicts, giving a death-rate of 23·72. The most fatal disease was dysentery, which contributed 63 deaths or 14 more than in 1899. More than a third of the deaths occurred from diseases of the lungs in one form or another.

Burma.

The health of the prisoners in the Burma jails was satisfactory throughout the year. The admissions to hospital per 1,000 of average strength fell from 584 to 555, the daily sick-rate rose from 27 to 28, and the death-rate from 18·7 to 21·2. In a few jails the accommodation was temporarily overstrained on occasions, but the pressure was relieved by transfers elsewhere. Of the 265 deaths which occurred during the year, all but 18 were of convicts, the death-rate being 20·27 against 18·44 in 1899. There were 33 cases of cholera with 20 deaths, which were spread over six jails; but the largest and only important outbreak occurred in Bassein jail, which returned 22 cases and 14 deaths. In the previous year there were 23 deaths from cholera. Ten of the 31 jails recorded death-rates exceeding the provincial average, but in several cases the average strength was small. The death-rate from all causes was highest at Bhamo (186·67) and Shwebo (72·85), while in eight jails there were no deaths during the year. Moulmein retains its reputation for unhealthiness, the number of admissions to hospital for dysentery alone being 298 out of a total for the whole province of 986.

Central Provinces.

The vital statistics of the jails of the Central Provinces for 1900 are very unsatisfactory, which is not surprising, as famine and disease were prevalent during the year, and increased the number of prisoners and made their physical condition bad. The ratios of admissions into hospital, of daily sick and of deaths, which in 1899 were 863, 27 and 24·4 per 1,000 of average strength, rose to 934, 30 and 69·0 respectively in 1900. All the jails except two were overcrowded at some time, but relief was obtained by utilizing worksheds inside the jails and by extra mural camps. "On the whole" the Inspector General remarks, "the vital statements seem to me to bear out the opinion I formed while inspecting in 1900, viz., that the jails fulfilled very successfully the extra function thrown on them by the famine of serving as hospitals for famine-stricken criminals." The average death-rate was made up of jail-rates varying from 190·14 in Seoni to 24·58 in Damoh. In seven other jails the death-rate was over 100 per 1,000.

Nine jails recorded cholera cases, the total being 51 with 35 deaths. In the previous year all the jails were free from cholera except Bilaspur, where there was one death from it. Under all other chief causes the mortality was greater than in 1899. Of the central jails, Raipur had the highest death-rate (66 per 1,000). This was due to a lingering epidemic of cerebrospinal fever which produced 22 cases and 21 deaths during the year. All kinds of expedients were resorted to, but the only efficacious one to ward off attacks was found to be to considerably reduce the population inside by establishing extra mural camps. All but 40 of the 392 deaths occurred among convicts, the death-rate being 68·2 per 1,000, against 24·4 in 1899.

Assam.

There was a marked improvement in the health of the prison population of Assam, the rate of admissions to hospital having fallen from 982 per 1,000 in 1899 to 817 in 1900, the daily sick-rate from 73 to 35, and the death-rate from 48·0 to 22·8. This great improvement in the death-rate was due to the greater care and attention which are now bestowed on the health of prisoners, to improved dietary, and also to the prohibition of extra mural labour during the unhealthy periods of the year. In only three of the 24 jails was the average strength above 100, viz., Sylhet, Tezpur, and Gauhati, and these three accounted for 31 out of the total 37 deaths. In the other jails the average strength varied from 6 to 88. In sixteen jails there were no deaths. All but two of the 37 deaths occurred among convicts, being in the ratio of 23·92 per 1,000 against 49·73 in 1899. There was only one case of cholera, and this occurred in Nowgong jail, terminating fatally; in the previous year there were 18 deaths from this disease. From dysentery and diarrhœa there were 10 deaths, and from malarial fevers 8.

Madras.

In the jails of Madras Presidency the general health of the prisoners was not so good as in 1899. The hospital admission rate rose from 411 per 1,000 of average strength in 1899 to 412, the daily sick-rate from 22 to 23 per 1,000, and the death-rate from 16·9 to 25·4. These results are mainly attributable to the unhealthiness of the season and its effect upon an exceptionally large jail population, a considerable portion of which was admitted into jail in impoverished health. From all the chief diseases the mortality among Madras prisoners was in excess of that of the previous year. Cholera appeared in an epidemic form in the Nellore and Russellkonda Hill jails, and in a sporadic form in four others. Of the total 19 deaths from this disease Nellore contributed 10. Excluding cholera there were only two deaths in this jail in an average strength of 233. Of the larger or central jails, Cannanore and Trichinopoly were the only ones in which the average jail death-rate of the Presidency was exceeded, the mortality in the former being 48·33 and in the latter 30·94. The highest death-rate was recorded by Russelkonda 72·75, followed by Nellore 51·50. In four other jails the mortality exceeded the rate for the Presidency; while in four jails there were no deaths. Of the total 326 deaths convicts contributed 287, representing a ratio of 27·50 per 1,000 of average strength, as compared with 16·70 in 1899.

Bombay.

The vital statistics of the jails in the Bombay Presidency were also much affected by the abnormal condition of the year. In most prisons there was considerable overcrowding, and although it was relieved as far as possible by transfers and by the provision of temporary accommodation, congestion was unavoidable to some extent. This and the feeble state in which convicts were admitted resulted in greater sickness and mortality. The rate of admissions to hospitals per 1,000 of average strength rose from 599 to 778, the daily sick-rate (25 per 1,000) was the same as in 1899, and the death-rate rose from 25·2 to 56·8 per 1,000. In five jails the death-rate was above the average rate for the Presidency, the highest being 126·5 in the Common Prison, Thana following with 107·0, Sind Gang 65·0, Ahmedabad 60.0, and Dhulia 57·2. Of the total 836 deaths, 571 occurred among the convicts, their death-rate being 48·4 against 25·9 in 1899, and 263 among undertrials, their death-rate being 92·1 per 1,000 of average strength. The chief causes of mortality were dysentery and diarrhœa 134 deaths, respiratory diseases 97, including cholera 72, and tubercle of the lungs, &c., 42. The most serious outbreaks of cholera were at Thana and Dhulia. In the former jail there were 38 deaths from this disease, representing a death-rate of 62·8, and in the latter 24, equal to a death-rate of 25·9 per 1,000 of average strength. From plague there were 32 deaths among the prisoners, of which 23 proved fatal, against only eight deaths in the previous year.

Berar.

Owing to the severe famine which prevailed in Berar in 1900 and to the general unhealthiness of the year the health of the jail population was exceptionally bad. The rate of admissions into hospital per 1,000 of average strength rose from 445 to 943, the

daily sick-rate from 13 to 27, and the death-rate from 13·3 to 79·9. The largest number of deaths in any previous year was 62 in 1897, but during the year under notice 154 deaths were recorded. The heavy mortality was, however, confined to three jails, Amraot and Akola having had 62 deaths each and Basim 24. The extraordinarily high death-rates of these three jails, viz., 136·9 at Basim, 105·7 at Amraoti and 89·28 at Akola were in a great measure due to the bad state of health of the prisoners on admission. Of the 24 deaths in Basim jail 15 were from dysentery and diarrhœa. At Amraoti an epidemic of influenza at the begining of the year, accompanied with a peculiarly fatal form of pneumonia, resulted in 13 deaths, an outbreak of cholera in this jail also resulted in 8 deaths, and from dysentery and diarrhœa there were 22 deaths. At Akola 11 deaths were from pneumonia, 3 from cholera and 19 from dysentery and diarrhœa. All but five of the 154 deaths occurred amongst convicts, their death-rate being 90·49 per 1,000, as compared with 13·52 in 1899.

V.—VACCINATION.

General results.

During 1900-01 there were 7,863,711 persons vaccinated in the several provinces of India, being a decrease of 234,546 on the number of the previous year. The falling off was chiefly in the Central Provinces, Berar, and Bombay, where famine and epidemic disease prevailed, and where exceptionally low birth rates and high mortality were returned. According to age, 3,076,214 children under one year of age, and 3,126,819 children between the ages of one and six years were successfully vaccinated during the year. The proportion of population protected against small-pox by the year's operations ranged from 62·8 in Coorg to 25·9 in Bombay. In the vaccination of infants the best results were obtained in the Punjab, followed by Berar, Bombay, the North-Western Provinces and Oudh, and the Central Provinces, where 55·7, 47·1, 45·7, 44·1, and 42·3 per cent. respectively of the children born during the year (estimated at 40 per 1,000 of population) were protected against small-pox. In the remaining provinces the percentage ranged from 33·5 in Burma to 12·2 in Coorg.

Statement showing the total number of persons successfully vaccinated during the year 1900–01 :—

Province.	Population among whom Vaccination was carried on (Census of 1891).	Number of Persons vaccinated.	Ratio of successful Vaccinations per 1,000 of Population.	Number of Children successfully vaccinated.		Percentage of Children born during the Year (calculated at 40 per 1,000 of Population) successfully vaccinated.
				Under One Year of Age.	Between One and Six Years of Age.	
Bengal	71,050,302	2,346,311	31·6	589,376	1,404,838	20·7
North-Western Provinces and Oudh.	47,146,033	1,549,409	31·1	831,483	510,483	44·1
Punjab	20,750,040	782,496	33·3	462,392	118,918	55·7
Burma	8,146,855	419,911	45·6	109,009	174,863	33·5
Central Provinces	12,944,805	455,397	33·4	218,824	115,483	42·3
Assam	6,122,201	271,466	42·0	53,146	131,457	21·7
Madras Presidency	35,651,577	1,257,883	31·0	350,763	539,188	24·6
Bombay Presidency	22,197,220	661,001	25·9	405,823	112,653	45·7
Berar	2,897,040	107,788	27·3	54,551	14,180	47·1
Coorg	173,055	12,049	62·8	847	4,756	12·2
TOTAL	227,079,128	7,863,711	31·8	3,076,214	3,126,819	33·9

Bengal.

The total number of vaccinations performed in Bengal during 1900–1901 was 2,346,311 of which 2,248,015 were successful, against corresponding figures in 1899–1900 of 2,252,521 and 2,221,210. This shows an increase of 93,790 vaccinations in 1900–1901, which was spread over 31 districts, the increase being most striking in Mymensingh (16,492), Chittagong (10,958), and Pabna (10,043). In 18 districts there was a decrease, the most marked instances being Balasore (13,254), Sonthal Parganas (12,295), Bankura (12,232), and Saran (11,267). In some cases the decrease was attributed to plague and in others to the unusual floods of September, or to the prevalence of malarial fever and cholera. The primary operations numbered 2,227,942, of which 97·75 per cent. were successful. According to age, 589,376 of the successful primary vaccinations were of children under one year of age, and 1,404,838 were between one and six years. For the whole province the successful vaccinations were in the proportion of 31·6 per 1,000 of the population. Estimating the births during the year at 40 per 1,000, the percentage of infants successfully vaccinated was 20·7, which is below that attained in any other province except Coorg.

Three methods of vaccination are practised in the province—(1) with lymph taken direct from the calf, from which 280,502 operations were performed; (2) with calf lymph prepared with lanoline, 220,347 operations; (3) with human lymph taken by arm to arm transfer, 1,727,093 operations. Compared with the previous year's figures there was an increase of 38,671 in the number of primary operations performed direct from the calf.

North-Western Provinces and Oudh.

In spite of the fact that most of the experienced vaccinators were deputed on plague duty and that it was necessary to use much caution in conducting operations where plague prevailed, the number of persons vaccinated in the North-Western Provinces and Oudh during 1900–01 rose from 1,511,431 in the previous year to 1,549,409. The increase was spread over 38 districts, the most marked being Bara Banki 9,706. Of the 1,414,776 successful primary cases, 831,483 were infants and 510,483 were children over one and under six years of age. Estimating the birth-rate at 40 per 1,000 of the population, 44·1 per cent. of the births were successfully vaccinated during the year. Calf lymph is only used at present to a small extent, arm-to-arm vaccination being generally practised throughout the provinces.

The provinces are divided into two circles for the purposes of control, each being in charge of a Commissioned Medical Officer, acting as Superintendent of Vaccination and Deputy Sanitary Commissioner. In the first or western circle, the average ratio of successful vaccinations was 32·55 per 1,000 of the population. In the second or eastern circle, the average ratio was 29·87. The Vaccination Act is in force in all the municipalities, but the thoroughness of enforcement still varies considerably. There was a decrease of 3,381 in successful primary vaccinations in these towns, and the proportion of persons successfully vaccinated per 1,000 of population declined from 37·97 per 1,000 in 1899 to 36·60.

Punjab.

There was a falling off in the aggregate number of vaccinations in the Punjab in 1900-01 of 160,578, as compared with the preceding year, viz., from 943,074 to 782,496. This is accounted for by the decrease of over 150,000 births, scarcity, malarial fever, a general unhealthiness which rendered children unfit for vaccination, and other causes. The primary vaccinations numbered 627,754 with a percentage of success of 94·44. The decrease is most notable in the Hissar district (31,526), Umballa (16,882), and Gurdaspur (14,711), the falling off being attributed mainly to the high mortality and sickness amongst children and to a small birth-rate. The number of successful cases among children under one year of age fell from 547,113 or 66·5 per cent. of the births, calculated at 40 per 1,000 of population, to 462,392 or 55·7 per cent. The provincial ratio of persons successfully vaccinated per 1,000 of the total population was 33·3, against 39·9 in the previous year. At the end of the year the Vaccination Act was in force in 25 towns and 12 cantonments.

Burma.

The total number of persons vaccinated in Burma during the year 1900–01 was 410,461, as compared with 490,887 in the previous year, showing a decrease of 80,426 operations. Out of 392,719 primary cases, 91·7 per cent. were successful, against 94·8 in the previous year. The number of infants protected was 109,009, equal to 33·5 per cent. of the births, estimated at 40 per 1,000 of the population. The returns for the Rangoon municipality continue to be unsatisfactory. The number of primary vaccinations fell from 2,457 to 2,265 and re-vaccinations from 2,899 to 2,677 ; while only 1,046 children under one year of age were successfully vaccinated out of a total of 3,143 births. As far as possible work was carried on with prepared animal lymph, but owing to the depots failing to meet demands, arm-to-arm vaccination had to be resorted to. As regards the attitude of the people, inoculation is carried on throughout the province, and Civil Surgeons generally, the Sanitary Commissioner states, report passive opposition to vaccination in favour of inoculation. The Act for the compulsory vaccination of children is in force in all the municipalities of the province, and, with a view to further provide for compulsory vaccination in the province, the Burma Vaccination Law Amendment Act was passed in 1899. This Act empowers Superintendents of Vaccination in Rangoon Municipality, and in other municipalities to which the Act may be extended, to require unprotected persons to be vaccinated, and provides also for the compulsory vaccination of inmates of lodging houses or coolie barracks. These powers, the Sanitary Commissioner with the Government of India observed, in his report for 1899, "should avail for the protection of the coolie immigrants in Rangoon, a class very liable to harbour and spread small-pox, the compulsory vaccination of whom was discontinued in August, 1896."

Central Provinces.

In the Central Provinces 455,397 persons were vaccinated during the year, showing a decrease of 53,926 on the number of the previous year. The falling off was entirely under primary vaccinations and was due to the low birth rate and high infant mortality which considerably reduced the number of children available. The closing of the relief camps, it is stated, also lessened the facilities, which had existed in the previous year, of vaccinating large numbers of children at a time. Primary vaccinations fell from 456,857 to 385,493 and the percentage of success from 96·97 to 96·50. The ratio

of successful vaccinations in the year to the total population was 33·42 per 1,000, as compared with 37·92 in 1899–1900. In the protection of infants there was a falling off of 87,845, the number vaccinated under one year of age during the year having fallen from 306,669 to 218,824, the latter number being equal to 42·3 per cent. of the births estimated at 40 per 1,000 of population. Animal lymph was used in the bulk of the vaccinations, and worked very successfully. Arm-to-arm vaccination is practised in very few places. With the lymph obtained from calves, 233,969 children were vaccinated during the year, and of these 223,737 were successful. The use of glycerinated lymph was attended with satisfactory results, the percentage of success attained being 86·97 against 86·27 in the previous year.

Assam.

During the year 1900–01 271,466 vaccinations were performed by all agencies in the province of Assam, showing a small decrease of 799 on the previous year's work. Of the total operations 251,263 were primary cases, and of these 95·99 per cent. were reported as successful, against 98·50 in the previous year. The Compulsory Vaccination Act continued in force during the year in the same 11 towns as in the previous year, wherein nearly 70 per cent. of the available children under one year of age were vaccinated. The number of infants successfully vaccinated in the province was 53,146, representing only 21·7 per cent. of the births, estimated at 40 per 1,000 of the population, and the proportion of the population successfully vaccinated in the year was 42·0 per 1,000. The Vaccination depôt at Shillong continued to work successfully, and 387,557 tubes were loaded with calf lymph against 317,382 in the previous year. The work of the province was entirely performed with this lymph.

Madras.

The total number of vaccinations performed in the Madras Presidency during 1900–1901 was 1,257,883, being an increase of 98,474 on the operations of the previous year. The increase was mainly attributable to the steady subsidence of the plague inoculation scare which operated detrimentally to vaccination in the two previous years. Of the total, 1,181,375 were primary cases, of which 91·9 per cent. were successful, practically the same as in the previous year, viz., 91·8. The number of children under one year of age successfully vaccinated rose from 324,249 to 350,763, which represented only 24·6 per cent. of the estimated births. Vaccination is compulsory in all municipalities, and the number of operations performed by municipal vaccinators rose from 120,442 to 131,195. In the town of Madras the number of operations performed was 32,571, an increase of 7,612 on the previous year. Of the 21 districts, six recorded a decrease of work. Chief among the causes assigned for the decline is the absence of members of the vaccination staff, without substitutes, on census and other special duty. Nearly all the operations were performed with animal lymph, and the best results were obtained, as usual, from calf-to-arm vaccination, with a percentage of success of 98·8.

Bombay.

There was a considerable decrease in the number vaccinated in the Bombay Presidency in 1900–1901 as compared with the previous year. The out-turn of vaccination work throughout the Presidency fell from 768,672 operations in 1899–1900 to 661,001. The decrease is attributed to the widespread famine and to epidemic disease which lowered the birth rate and raised the infantile mortality rate. The total primary cases fell from 679,467 to 586,478, the percentages of success being respectively 92·84 and 90·86. No other lymph except animal and human was used in the Presidency during the year. The relative results obtained are not given in the Sanitary Commissioner's report, but these are to be supplied in future. In the City of Bombay vaccination with animal lymph has been in use for many years past. Of the successful primary cases, 76 per cent. were infants under one year of age. Reckoning the births in the Presidency at 40 per 1,000 of population, 45·7 per cent. were protected from small-pox. No inoculation was reported to have been practised anywhere during the year, except in the towns of Karachi and Hyderabad. The protection afforded to the population by the year's operations was in the ratio of 25·9 per 1,000.

Berar.

Famine and epidemic disease and the absence of the staff on special duty connected therewith greatly interfered with vaccination work in Berar during the year. The number of persons vaccinated fell from 175,901 in the previous year to 107,788, or a decrease of 68,113. The primary vaccinations fell from 120,772 to 74,707 ; but the percentage of success rose from 95·8 to 96·6. Of the total number of successful primary operations, 54,551 were performed on infants under one year of age ; estimating the births at 40 per 1,000 of population, 47·1 per cent. were protected against small-pox, and the proportion of population protected by vaccination fell from 43·2 per 1,000 in the previous year to 27·3. The decrease in primary vaccinations was spread over all the districts. Owing to the famine, calves in sufficient numbers were not available to raise fresh calf lymph, and

lanolinated calf-lymph manufactured at Amraoti was used from April to November, thereafter to the end of the working season fresh calf-lymph was used. The Sanitary Commissioner continues his statement, showing the efficacy of vaccination in checking small-pox mortality in Berar; the ratio of successful vaccinations per 1,000 of population has risen from 8·92, the mean of five years 1868–69 to 1872–73, to 33·6, the mean of five years ending 1897–98; the mortality from small-pox for the same periods has declined from 2·02 to 0·19 per 1,000. In 1898–99, 1899–1900, and 1900–01, the ratios of successful vaccinations per 1,000 of population were 34·6, 43·2 and 27·3, and the death-rate from small-pox 0·2, 0·1 and 0·3 per 1,000. The Vaccination Act is in force in all the municipal towns.

VI.—MEDICAL INSTITUTIONS.

Civil Hospitals and Dispensaries.

The following comparative statement shows the number of hospitals and dispensaries open in the several provinces of India during 1900 and the previous year, and the number of patients under treatment :—

Provinces, &c.		Number of Institutions.	Number of In-door Patients.	Number of Out-door Patients.	Total Number of Patients.
Bengal	1900	531	50,097	3,417,284	3,467,381
	1899	513	47,897	3,243,346	3,291,243
Calcutta and Howrah	1900	17	28,372	251,822	280,194
	1899	15	24,146	219,302	243,448
North-Western Provinces and Oudh	1900	484	55,394	3,577,776	3,633,170
	1899	374	59,643	3,939,022	3,998,665
Punjab	1900	273	59,328	3,379,034	3,438,362
	1899	272	51,967	3,102,310	3,154,277
Burma	1900	113	36,095	822,594	858,689
	1899	110	34,749	783,290	818,039
Central Provinces	1900	175	13,725	1,330,261	1,343,986
	1899	127	11,434	1,520,208	1,531,642
Assam	1900	128	6,369	696,221	702,590
	1899	115	6,217	617,586	623,803
Coorg	1900	7	1,434	44,276	45,710
	1899	7	1,040	32,713	33,753
Madras	1900	551	64,269	4,621,484	4,685,753
	1899	537	63,184	4,375,053	4,438,237
Bombay	1900	547	50,888	1,485,534	1,536,422
	1899	354	50,902	2,078,979	2,129,881
Berar	1900	48	7,315	318,375	325,690
	1899	48	4,590	327,108	331,698
TOTAL	1900	2,874	373,286	19,944,661	20,317,947
	1899	2,472	355,769	20,238,917	20,594,686

Bengal. The total number of dispensaries at work during 1900 in Bengal, exclusive of the medical institutions at Calcutta, was 531, an increase of 18 on the number of the preceding year. At these there were 3,467,381 patients under treatment, 50,097 being in-door and 3,417,284 out-door patients, against 47,897 and 3,243,346 respectively in the previous year. This shows a total increase of 176,138. "It is to be feared," the Lieutenant-Governor remarks, "that the increase in the number of patients is due as much to the unhealthiness of the year as to the popularity of the Government dispensaries, and it would in all probability have been much greater but for the prevalence of plague in some of the districts which deterred people from seeking medical relief in some of the dispensaries."

There was again a satisfactory increase in the number both of women and children patients. The increase among women amounted to 21,705, the number having risen from 517,858 to 539,563. The proportion of women, however, was much about the same as in the previous year, viz., 17·55 against 17·84 per cent. Of the diseases under treatment at the dispensaries, malarial fevers, skin diseases, and dysentery and diarrhœa were responsible, as usual, for the largest number of cases. From malarial fever there were 629,746 cases, equal to nearly 19 per cent. of the total number of patients, against 623,173 in 1899 ; from skin diseases the number of cases rose from 501,830 to 591,500 ; from dysentery and diarrhœa there were 185,507 cases, against 160,060 in 1899. From cholera the number of patients rose from 10,638 to 21,371. Cases of venereal diseases rose from 81,602 to

82,131. The number of deaths among in-door patients rose from 5,559 or 116·0 per 1,000 of total treated in 1899 to 6,430 or 128·3 in 1900. During the year 656 plague cases were treated in the dispensaries against 2 during 1899, the majority receiving treatment at dispensaries in the Gaya district. A disease locally known as "Batphut," which was ascertained to be prevalent in a portion of Khondmals of the Orissa Tributary States was, under the orders of the Government, investigated and pronounced to be one of virulent syphilis, probably introduced, it is stated, from the Sonpur Native State in the Central Provinces; necessary measures were taken for the treatment of the disease locally. Great attention is paid in these institutions to surgery, and during the year 146,580 operations were performed, against 145,379 in 1899, and of these 191 terminated fatally. Among the more important operations there were 2,388 cases of extraction of the lens.

The following statement shows the number of in-door and out-door patients treated in the several hospitals and dispensaries in Calcutta and Howrah during 1900 and the previous year :—

Name of Institution.	1899.				1900.			
	In-door Patients.	Out-door Patients.	Total Number of Patients.	Died per 1,000 of In-door Patients treated.	In-door Patients.	Out-door Patients.	Total Number of Patients.	Died per 1,000 of In-door Patients treated.
Medical College Hospital	4,482	34,338	38,820	156·0	5,257	35,075	40,332	160·9
Eden Hospital	1,547	2,125	3,672	75·6	1,718	2,217	3,935	72·7
Ezra Hospital..	230	—	230	30·4	238	—	238	2·1
Shama Churn Law Eye Hospital	476	13,103	13,579	2·1	516	12,816	13,332	—
Presidency General Hospital	2,993	1,118	4,111	44·4	2,722	1,119	3,841	53·6
Campbell Hospital	6,823	20,288	27,111	256·0	8,843	23,449	32,292	323·9
Police Hospital	2,966	—	2,996	6·9	3,673	—	3,673	8·9
Mayo Native Hospital	1,710	23,674	25,384	130·6	1,703	24,209	26,002	109·8
Chandney Hospital	276	38,706	38,982	119·5	360	44,385	44,745	27·7
Park Street Dispensary	—	24,529	24,529	—	—	28,018	28,018	—
Chitpore Dispensary	—	15,939	15,939	—	—	19,380	19,380	—
Sukea's Street Dispensary	—	13,492	13,492	—	—	13,524	13,524	—
Dufferin Victoria Hospital	164	4,077	4,241	12·1	158	4,826	4,984	50·6
Sambu Nath Pandit Hospital	831	15,783	16,614	173·2	1,135	18,973	20,108	157·7
Kidderpore Municipal Dispensary	—	—	—	—	—	5,207	5,207	—
„ Dockyard „	—	—	—	—	—	6,731	6,731	—
Total Calcutta Hospitals and Dispensaries	22,528	207,172	229,700	138·9	26,413	239,929	266,342	167·1
Howrah General Hospital	1,618	12,130	13,748	202·7	1,959	11,893	13,852	246·5
Grand Total	24,146	219,302	243,448	143·2	28,372	251,822	280,194	172·5

The figures for 1900 show an increase of 32,520 in out-door patients, and of 4,226 in in-door patients. The increases were mainly due to the unhealthiness of the year and to the inclusion for the first time in the Calcutta list of the statistics of the Municipal and Dockyard Dispensaries at Kidderpore, which had hitherto been shown in the provincial list. The death-rate for all the hospitals was 172·5 per 1,000 of the total in-patients, against 143·2 in the previous year. Cholera patients rose from 355 to 728, and the fatal cases from 227 to 445. The increase was most marked in the Campbell Hospital, where 271 cases were treated against 136 in the previous year. Small-pox was more prevalent in Calcutta than in the previous year, and the cases admitted to hospital rose from 42 to 240. Dysentery patients rose from 6,404 to 9,171. The number of patients treated for diarrhœa also rose from 6,673 to 8,949; malarial fever was responsible for 54,571 patients against 46,138. Plague cases treated rose from 229 to 449, and the deaths from 198 to 357. Venereal diseases show an increase of 1,169 patients, the number treated having risen from 11,159 in the previous year to 12,328. Surgical operations increased from 25,109 to 26,023, and death ensued in 188 cases, against 154 in 1899.

North-Western Provinces and Oudh.

During 1900 there were 484 hospitals and dispensaries at work in the North-Western Provinces and Oudh, or 110 more than in the previous year. The number of patients who received medical aid was 3,633,170 against 3,998,665 in 1899. There was thus a decrease

in 1900 of 365,495. The number of in-patients fell from 59,643 to 55,394. The decrease in attendance was due in a great measure to plague preventive measures, which deterred patients from seeking medical relief at Government charitable dispensaries. Of the total number, 51·9 per cent. were men, 22·4 per cent. were women, and 25·7 per cent. were children, the first and last showing a small increase on the figures of the previous year. Among the in-door patients there were 3,099 deaths, against 2,865, and the death-rate rose from 48·0 to 55·9 per 1,000. Of the diseases for which the patients were treated 536,029 were suffering from malarial fevers, a decrease of 125,124 on the number of 1899 ; 4,679 cases of cholera were treated in the dispensaries, against 520, and cases of diseases of the eye fell from 365,369 to 337,464. From venereal diseases there were 81,765 patients, against 82,884 in the previous year. The number of surgical cases rose from 180,190 to 182,986, of which 154,102 resulted in cure and 389 were fatal. Of the total operations 5,373 were for cataract, of which nearly 83 per cent. were successful, as compared with 5,778 operations and a percentage of success of 84 in 1899.

Punjab.

The number of dispensaries at work in the Punjab during 1900 was 273 or one more than in the previous year, but no less than 40 dispensaries had to be temporarily closed in order to provide Hospital assistants for plague and famine duties. During the year 3,438,362 patients were under treatment, being an increase of 284,085 on the number of 1899. The attendance of in-door patients was greater than in the previous year by 7,361, the number having risen from 51,967 to 59,328. Considering the general unhealthiness of the province during the year this large increase is not to be wondered at. Of the diseases for which patients sought relief there were 4,663 cases of cholera, a large increase on 219 in 1899. Owing to the heavy continued rain cases of malarial fever rose from 381,465 to 655,914. Diseases of the eye showed a decrease of 5,683 cases, the number treated in 1900 being 442,699, against 448,382. From venereal diseases there were 33,442 cases under treatment, an increase of 3,440 on the previous year's figures. Among the in-patients there were 4,079 deaths during the year, being in the ratio of 68·7 per 1,000 of the number treated, against a death-rate of 44·1 in 1899. The number of surgical operations amounted to 165,222, which, compared with the previous year, shows a decrease of 4,829 operations ; but the decrease was in minor operations. Of the total operations, 159,851 resulted in cure and 258 were fatal. There were 5,614 cataract operations, and of these 89·9 per cent. resulted in cure.

Burma.

The number of dispensaries existing in Burma at the end of 1900 was 113, or three more than in the previous year. At these, 858,689 patients attended, as compared with 818,039 in 1899. The number of in-door patients rose from 34,749 to 36,095, of whom 26,540 were cured, and 2,724 or 75 per 1,000 died, against 2,611 deaths or 75 per 1,000 in the previous year. Nearly 57 per cent. of the patients treated were Burmese. Malarial fevers, as usual, headed the list of maladies under treatment, the number of cases being 136,619, against 126,373 in the previous year. Cholera was not so prevalent as in 1899, and the number of cases fell from 581 to 221. Cases of venereal disease rose from 24,627 in 1899 to 29,692 Surgical work showed an increase of 1,907 operations, the number performed during the year having risen from 17,154 to 19,061. The number of patients cured, after being subject to operation, was 18,259 and 101 died.

The figures for the Dufferin Hospital are given in the Inspector General's report for 1900 for the first time. The total number of patients during 1900 was 1,223, of whom 512 were in-door. This hospital provides accommodation for maternity and for gynecological cases, besides quarters for 24 pupil midwives, who undergo a course of instruction in midwifery and sick-nursing. Since the opening of the hospital in 1888, 154 nurses have passed out, and of these 14 are at present in the employment of municipalities.

Central Provinces.

The number of hospitals and dispensaries at work in the Central Provinces during 1900 was 175, or 48 more than in the previous year. The total number of patients fell from 1,531,642 to 1,343,986. The decrease, however, extended only to out-door patients, the in-door patients having risen from 11,434 to 13,725. The increase in in-patients was chiefly due to the free admission of cholera and famine-stricken patients and to the exceptional unhealthiness of the year. Among the in-patients there were 2,083 deaths, or 151·2 per 1,000 of total treated, against 892 or 78·0 in 1899. As regards the different kinds of diseases, malarial fevers headed the list with 314,884 cases. From cholera there were 6,566 cases, from dysentery and diarrhœa 79,103 cases, and from venereal diseases 28,489 cases. The number of surgical operations fell from 34,884 in 1899 to 32,472. Of these, 31,631 resulted in cure and 69 in death. Of the more important operations, 731 were for extraction of the lens.

Assam. In the province of Assam there were 128 dispensaries at work during the year, or 13 more than in the previous year. There was a further large increase in the number of patients, the total under treatment having risen from 623,803 in 1899 to 702,590 in 1900. These institutions, it is stated, are steadily becoming more useful and better appreciated by the people. The number of in-patients rose for the first time for four years, viz., from 6,217 to 6,369, and of these 4,040 were discharged cured, 483 relieved, 659 discharged otherwise, and 894 died, the latter representing 140·4 per 1,000 of the total in-patients, against a ratio of 151.5 in 1899. The attendance of men and children increased, while the attendance of women fell off, in spite of the fact that separate consulting rooms were set apart for women at almost all dispensaries. Of the total number of persons who received medical aid, malarial fever accounted for 125,231 cases, including 2,013 suffering from kala-azar, against 3,736 of these cases in the previous year; dysentery and diarrhœa 23,745, and venereal diseases 7,721. Cholera patients rose from 1,449 in 1899 to 2,717. Of surgical cases there were 16,035, of which 15,423 were cured and 41 were fatal.

Madras. Exclusive of the hospitals in the Presidency town there were 537 civil hospitals and dispensaries working in Madras at the close of 1900, or 14 more than in 1899, and at these there were 4,448,881 patients under treatment, exceeding the number of the previous year by 222,573. Of the 44,716 in-door patients, 27,500 were returned as having been cured under treatment, 9,017 as relieved, and 3,356 as otherwise discharged. The deaths numbered 3,442, representing a ratio of 77·0 per 1,000 of the total in-patients, against 54·2 in the previous year. Ulcers and diseases of the skin, malarial fevers, diseases of the digestive system, rheumatic affections, and diseases of the eye were the most common complaints under treatment during the year. Cholera was much more prevalent in the Presidency than in the previous year, and the cases under treatment in the various hospitals and dispensaries rose from 3,234 to 9,571. From venereal diseases there were 79,570 cases, against 78,002 in 1899. The surgical operations rose from 121,261 in 1899 to 137,407. Of these, 131,709 were cured and 146 were fatal.

The number of medical institutions in Madras town remained the same (14) as in 1899, but the number of sick treated rose from 211,929 to 236,872. The in-patients rose from 16,674 to 19,553, and amongst them 9,739 cases were recorded to have been cured or perfectly recovered, 3,819 were relieved, 3,474 discharged otherwise, and 1,501 or 76·8 per 1,000 died, against a rate of mortality in 1899 of 65·6. The increase in mortality was due to cholera in an epidemic form. Of the several diseases for which the patients were treated, malarial fever, diseases of the digestive system, skin, and respiratory system were, as usual, the most common. From cholera there were 344 cases, against 28 in the previous year, from dysentery and diarrhœa 8,081, and from venereal diseases 4,324. Slightly fewer surgical operations were performed, the number having declined from 16,243 in 1899 to 16,226. The results showed that 13,349 cases were cured, 2,234 were relieved, and 127 were fatal.

At the Madras Voluntary Venereal Hospital, which is included in the above hospitals in the city, there were 525 female patients treated during 1899, an increase of 13 on the number of the previous year. Of these, 204 were cured and 14 died.

Bombay. Excluding the 11 medical institutions in the City of Bombay, there were 536 hospitals and dispensaries working in the Presidency at the end of 1900. At these, 1,416,517 patients were under treatment, of whom 32,501 were in-door and 1,384,016 out-door patients, against 32,831 and 2,029,422 respectively in 1899. Malarial fevers, as usual, constituted by far the largest number of cases (523,584), and showed an increase of 175,837 on the figures of the previous year. Next to fever, eye and skin diseases and worms were the most common ailments. All the important diseases except two showed an increase. Cholera cases rose from 630 to 20,002; dysentery cases were also more numerous; and patients suffering from venereal affections rose from 32,861 in 1899 to 46,086 in 1900. Of the in-door patients 22,759 were cured, 2,280 relieved, 1,939 discharged otherwise, and 4,357 died, the ratio of deaths to total treated being 134 per 1,000, against 134 in the preceding year. The total number of patients operated on was 52,123, as compared with 72,518 in 1899, and of these 41,019 were cured and 187 died. The large decrease in the number of operations was mainly under those for abscesses (8,012) and those on the teeth (9,545.)

The total number of patients treated at the 11 civil medical institutions working in the town of Bombay during 1900 showed an increase of 19,446, the figures being 119,905, against 100,459 in the previous year. The in-patients increased in number from 18,071 to 18,387, and of these 10,610 were cured, 2,489 relieved, 1,037 otherwise discharged, and

3,265 died, the deaths being in the ratio of 178 per 1,000 of the in-patients, against 129 per 1,000 in 1899. As usual, local injuries, malarial fevers, and eye diseases were the chief complaints treated. Venereal diseases contributed 4,405 cases, against 3,626. From cholera 75 cases were under treatment; and dysentery cases rose from 1,449 to 2,558, and diarrhœa cases from 3,805 to 4,047. The total number of patients operated on was 10,842, and of these 7,029 were cured, 187 relieved, 68 discharged otherwise, and 206 died.

Berar. There were 48 medical institutions at work in Berar during 1900, the same as in the three previous years. Of these, eight are hospitals wholly maintained by the State. The total number of patients under treatment was 325,690, against 331,698 in 1899. In-patients numbered 7,315, and of these 5,356 were cured and 1,122 died, which gives a death-rate of 153·7 per 1,000. The apparent diminished attendance was more than counterbalanced by the number of patients who were treated at the special hospitals attached to poor-houses and relief camps throughout the province. Malarial fevers continued to head the list of diseases from which relief was sought; nearly a fifth of the total patients were treated under this head; diseases of the eye and diseases of the digestive system came next in order. The number of surgical operations was 9,882, against 11,104 in 1899. Of these, 9,678 were cured and 41 were fatal.

The work of the Lady Dufferin Hospital for women and children at Amraoti continued to show progress. The number of in-door patients rose from 151 in 1899 to 230, but the out-door patients fell slightly, from 6,847 to 6,839. The number of operations performed rose from 120 to 139.

Lunatic Asylums.

Bengal. At the five asylums in Bengal (viz., Dullunda, Dacca, Patna, Cuttack, and Berhampore) 1,123 lunatics, including 234 fresh admissions and re-admissions, were under treatment in 1900, being a decrease of 8 on the number of the previous year. In the course of the year under notice 81 patients were discharged as cured, and 19 as improved or otherwise, and 96 died. Compared with the figures of 1899, the number discharged was less by 34, and the mortality more by 14. At the end of the year there were 906 persons still under detention, or 17 more than at the close of 1899. The improvement in the health of the inmates noticed during the two previous years was not maintained in 1900. The number of admissions to hospital rose from 576 to 962; the average daily number of sick fell from 86 to 97; while the death-rate rose from 96·3 to 106·8 per 1,000 of average strength. The cause of insanity was traceable only in 80 of the 234 fresh admissions, and 23 of these were ascribed to ganja smoking. The results of the working of dairy farms at the asylums were not on the whole so satisfactory as in the previous year. At Dullunda there was a profit of £58 as compared with £55 in the previous year. At Dacca the dairy was worked at a loss owing to bad management. The dairy farm at Berhampore also showed a smaller profit. The usefulness of the dairy farms, however, is not indicated so much in the profits as in the supply of pure milk and in the congenial work which they afford to the lunatics.

In the Bhowanipur Asylum, containing European and Eurasian patients only, the inmates during 1900 numbered 53, or one less than in the previous year. Of this number 37 were under detention at the beginning of the year, and 16 were subsequently admitted. In the course of the year 10 patients were discharged, 4 died, and two were despatched to Europe as still insane, leaving 37 under confinement at the close of the year. As regards the health of the patients during the year, there were only 6 admissions to hospital, the same as in the previous year, and 4 deaths, also the same as in 1899.

North-Western Provinces and Oudh. The inmates of the four lunatic asylums (Agra, Bareilly, Benares, and Lucknow) in the North-Western Provinces and Oudh in 1900 numbered 1,358, including 243 fresh admissions during the year, against 1,349 in 1899. Before the close of the year 161 patients were discharged, of whom 138 were reported as cured, 28 were made over to friends, 82 died, and 3 were discharged, leaving 1,112 under treatment at the end of the year. There was less sickness in the asylums than in the previous year, the total number of sick treated in hospital having fallen from 1,313 to 1,140, but the total mortality rose from 72 to 82. The health of the Bareilly asylum was very unsatisfactory during the year, and the number of deaths (32) was the largest recorded for many years, phthisis and cholera being the chief causes of mortality with 10 and 6 deaths respectively. Cholera was not present in any other asylum. The scheme for a large central institution at Agra, under the charge of a whole-time Superintendent, was being carried out. Buildings for Europeans and Eurasian lunatics were completed, and the plans of the other new buildings were approved.

Punjab. The new Central Lunatic Asylum for the province of the Punjab was opened on the 1st March, 1900, and within that month the patients from the old asylums at Lahore and Delhi were transferred to it, and the two institutions were permanently closed. The total number of lunatics in the Punjab lunatic asylum during 1900 was 608, including 151 fresh admissions, against 607 in 1899. At the end of the year the number was reduced to 482 by the discharge of 76 patients, 38 as cured, 34 made over to friends, and 4 otherwise discharged, and 50 deaths. As regards the health of the inmates of the asylum, the number of admissions to hospital during the year was 436, the daily average sick 42, and the death-rate 105·9 per 1,000 of average strength. Of the 50 deaths, 11 were from tuberculosis of the lungs, 11 from pneumonia, and nine from dysentery. Of the total number of admissions, in more than one half (81) the cause of insanity was unknown.

Burma. The Rangoon Asylum is the only one in the province of Burma, and has accommodation for 404 insanes. During 1900 there were 473 patients in the asylum, including 105 fresh admissions, and the total was reduced at the close of the year to 390 by the discharge of 60 patients for different causes, and the death of 23. As regards the general health of the inmates, the daily sick rose from 13·8 to 17·1, but the deaths fell from 30 or 83·3 per 1,000 of average strength to 23 or 60·3.

Central Provinces. In the two asylums of the Central Provinces (Nagpur and Jubbulpore), there were 393 lunatics under treatment during 1900, a decrease of 2 on the number in 1899. In the course of the year 58 patients were discharged as cured or otherwise, and 23 died, leaving 312 still under treatment at the end of the year. The health of the inmates was not quite so good as in the previous year. The admissions to hospital at Nagpur rose from 69 to 98, and at Jubbulpore they fell from 93 to 90. The increase at Nagpur was due to the fact that many debilitated patients were kept in hospital for long periods during the year. Of the total 23 deaths, Nagpur recorded 19, being in the ratio of 115·2 per 1,000 of average strength, against 11 or 63·6 in 1899. At Jubbulpore there were 4 deaths, being in the ratio of 24·8 per 1,000, against 3 or 19·4 in 1899. Of the 50 admissions during the year, 17 were returned as due to unknown causes.

Assam. There is only one lunatic asylum in the province of Assam, and this is situated in Tezpur. The total number of lunatics under treatment in the asylum during 1900 was 150, or three more than in the previous year. Of these, 31 were fresh admissions. At the close of the year the patients in the asylum were reduced to 114, 19 of the total number having been discharged, and 17 having died. The health of the inmates was not satisfactory. There were 159 admissions to hospital, as compared with 57 in 1899. The daily average sick was 11, and the number of deaths was more by eight than in 1899, while the death-rate rose from 71·1 per 1,000 of average strength to 138·6. It is explained that five of the deaths were due to phthisis, which could not be prevented. The causes of insanity were unknown in 10 of the fresh admissions.

The increased sickness and mortality were due chiefly to diarrhœa and dysentery, but there was also a general increase all round.

Madras. At the commencement of 1900 there were 554 patients under treatment in the three lunatic asylums (Madras, Vizagapatam, and Calicut) of the Madras Presidency. During the year 161 fresh cases were admitted, bringing the total population up to 715, or 13 less than the number in the preceding year. In the course of 1900 there were 107 cases of discharge, and of these 96 were cured or improved. The accommodation was ample, and there was no overcrowding in any of the asylums during the year. On the whole there was less sickness among the patients than in the previous year, and there were no epidemics in the Madras and Calicut Asylums; but in the month of May influenza was prevalent in the asylum at Vizagapatam, and 26 cases were admitted. The daily average sick fell from 81 to 74, and the deaths from 59, or 101·1 per 1,000 of average daily strength, to 49 or 89·8. Of the total 49 deaths the Madras Asylum contributed 41, giving a death-rate of 104·2 per 1,000 on an average strength of 394, against a ratio of 117·7 in 1899. The death-rates of the other two asylums, Vizagapatam and Calicut, were 57·0 and 49·0 per 1,000 respectively, against 28·0 and 77·2 in the previous year. Of the 41 deaths in the Madras Asylum five died within less than three months of admission, while 14 deaths occurred among patients of over five years residence in the Asylum. Of the 161 fresh admissions, the causes of insanity were unknown in 78 or 48·45 per cent.

Bombay. The total population of the six lunatic asylums of the Bombay Presidency (Colaba, Ratnagiri, Poona, Dharwar, Ahmedabad, and Sir Cowasji Jehangir, Hyderabad) was 1,089, including 285 fresh admissions, against 1,114 in 1899. In the course of the year 191

patients were discharged, 73 of them as cured, and 139 died, leaving 759 under treatment at the close of the year. There was considerably more sickness in the asylums than in 1899, the daily average sick having increased from 37 to 42, and the death-rate from 108·2 per 1,000 of average strength to 178·0. Of the 139 deaths, diarrhœa and cholera accounted for 38. Slightly more than half the deaths (71) occurred in the Colaba Asylum, the death-rate being nearly 240 per 1,000 of average strength, against 168·2 in the previous year. The highest death-rate was recorded at the Sir Cowasji Jehangir Asylum at Hyderabad, viz., 271 per 1,000, the result of 28 deaths.

Medical Schools.

Bengal.

The number of medical schools open in Bengal during 1900–1901 was 10, or one more than in the previous year. The Medical College, Calcutta, and four of the medical schools are maintained by Government, the rest are unaided. The college is affiliated to the University, and prepares candidates for its various medical degrees. The four Government medical schools train pupils as Civil Hospital Assistants, and the five unaided schools follow their own standards for private practice.

The students of the Medical College are required to undergo three University examinations during their five years' study, viz., the Preliminary Scientific examination at the end of the second year, the first L.M.S. or the first M.B. examination at the end of the third year, and the second L.M.S. or second M.B. examination at the end of the fifth year. The total strength of the College at the end of the session 1900–01 was 569 (including 12 women), against 502 in the preceding year. As regards the examinations, 214 candidates were successful out of a total of 506, the successes being at the rate of 42·29 per cent., as compared with 37·35 per cent. in 1899–1900. Of the 214 successful candidates, 49 passed the Preliminary Scientific L.M.S. examination, 42 passed the first, and 65 the second L.M.S. examinations; 26 passed the Preliminary Scientific M.B. examination; six passed the first and three the second M.B. examinations. For the combined Preliminary Scientific and First L.M.S. examinations, five passed the first L.M.S examination and 13 the Preliminary Scientific L.M.S. examination; and for the combined Preliminary Scientific and First M.B. examinations one passed the first M.B. examination and four the Preliminary Scientific M.B. examination.

Sixteen pupil nurses passed their examinations and received midwife's certificates. Ten native *dais* passed in midwifery from the Eden Hospital, and also received certificates.

The total number of students attending the four Government Vernacular Medical Schools at Calcutta, Patna, Dacca and Cuttack was 607 (including 35 women), against 637 (including 37 women) in the previous year. The largest attendance was at the Campbell School, Calcutta, the number of students being 197 (including 19 women). The total number of passes was 88 (including only two women from the Dacca school).

North-Western Provinces and Oudh.

The number of pupils attending the Agra Medical School in 1900–01 was 232 (including 50 women), or 12 less than in the preceding year. "The general conduct of the pupils, both male and female, during the year," it is reported, "was satisfactory. With regard to their ability and application it is more difficult to speak. The pass lists show the usual variations in the number of marks gained in the different classes, most of which are up to the average of the past five years." Of the 182 male students, 34 passed out into the service. As regards the examination of women students, five in the first class obtained their diplomas.

Punjab.

The average attendance at the Lahore Medical College and School was more by 14 as compared with that of 1899–1900, viz., 443 against 429. Of these 181 were in the College, and 262 in the Medical School. The results of the year's examinations show that for the Preliminary Scientific Examination, 9 out of 23 candidates passed. In the first L.M.S. and M.B. examinations, 28 candidates out of 45 passed, against 18 out of 50 in the previous year, and in the second L.M.S. and M.B. examinations 21 out of 43 passed, against 28 out of 50; in all 58 out of 111, or 52 per cent. were successful, as compared with 65 out of 126, or 51 per cent. in the previous year. In the final examination for the hospital assistant diploma 52 passed out of 65, or 80 per cent. Of the students on the rolls 14 were women.

The Medical School for Christian women continues to make progress and to do good work at Ludhiana. The object of the institution is "to provide a thorough medical training, under fully qualified Christian women, for those Christian women and girls who wish to prepare themselves for medical mission work." At the end of 1900 there

were 43 students on the rolls, or 15 less than in the previous year; of these 15 belonged to the Medical classes, five to the Compounders' classes, 7 to the Dais' classes, and the rest to the Nurses' classes.

Madras. The number of students at the Madras Medical College (including the School Department) during 1900–01 was 510, of whom 32 were women students. In the Hospital Assistant Department, consisting of 194 pupils, 45 appeared for the final examination and 31 passed, all in the second class. The results of the several University examinations in medicine were not so satisfactory, only 31 having passed out of 68 candidates entered, against 44 out of 66 in 1899. In the College Department there were 69 regular students, including three women students, reading for the M.B. and C.M. degree, 32 reading for the L.M.S. degree, and 20 casual students.

The only other medical school at work during the year was the Prince of Wales' Medical School, Tanjore. At this there were 29 pupils on the rolls, all of whom were being prepared for the Hospital Assistants' Certificate. Thirteen candidates appeared for the final examination and 5 passed.

Bombay The attendance at the Grant Medical College, Bombay, rose from 368 in 1899–1900 to 439 (including 31 women and 38 military pupils) in 1900–01. For the first University examination in medicine 175 candidates presented themselves, of whom only 98 qualified; and for the second examination in medicine only 54 passed out of 132 candidates. For the final examination for the degree of L.M.S there were 61 candidates, and of these only 22 passed.

The Government Medical Schools at Poona, Ahmedabad, and Hyderabad continued to work satisfactorily. The average number of students on the rolls was 235, and the results of the examinations were satisfactory.

VII.—SANITATION.

In Calcutta the improvement of bustees, or clusters of Native huts continued to receive attention. In the matter of water supply there is nothing to record but the ordinary working of the existing system. The average daily consumption of filtered water was 20,561,908 gallons, equal to over 24 gallons per head of the census population of 1901. The total length of filtered water mains and services amounted at the close of the year to 315 miles. A further advance was made during the year in increasing the supply of unfiltered water. The length of the unfiltered water mains and services in the town and added area at the close of the year was 156 miles. The consumption of unfiltered water was 13,109,390 gallons, against 9,687,500 gallons in the previous year; the daily consumption per head of population was over 15 gallons. Good progress was made during the year in the work connected with the sewage and storm water outfalls of the town and suburbs. Various reconstructions and improvements were made in the sewerage system which at the close of the year had a length of over 200 miles, and the number of premises connected with the system was 31,295, of which 625 connections were made during the year. The most important portions of the drainage schemes were held in abeyance owing to the Corporation having thought it necessary to refer the scheme to an English expert, Mr. Baldwin Latham. His report has since been received, and it is hoped that it will be speedily dealt with. **Bengal.**

The municipalities of the interior of Bengal spent £140,486 or nearly 45 per cent. of their income on sanitary works being an increase of about £12,000 on the expenditure of the previous year. In addition, various sanitary works were carried out by Municipalities and District Boards, by Government, and by private individuals at a total cost of £61,000.

The Sanitary Board held three meetings during the year, and continued as usual to advise the Government and local bodies on the important sanitary projects of the year. Among these were schemes for the improvement of the water supply of Manicktollah and South Suburban municipalities, and drainage projects for the important towns of Monghyr, Khulna, Dinajpore and Rangpur. Among the more important preliminary estimates prepared under the orders of the Board during the year were the Patna water works and a combined scheme for water supply to the riparian municipalities.

In the North-Western Provinces and Oudh nine towns, Agra, Allahabad, Benares, Cawnpore, Lucknow, Meerut, Mussoorie, Dehra Dun, and Naini Tal, are now furnished with waterworks and pumping machinery; these towns contain about one-third of the municipal population of the province. At Agra the water supply arrangements were further improved during the year; in Benares the large sewerage works were in progress, and measures were taken for the prevention of the pollution of the Ganges at the same place; and in Cawnpore an important scheme for the drainage and sewerage of the city was under consideration. Village sanitation books were introduced in 20 additional districts, making a total of 42 districts in which these books are now maintained. "A systematic record of the defects noticed and improvements made in the sanitation of towns and large villages cannot fail," it is observed, "to have a salutary effect." **North-Western Provinces and Oudh.**

The Sanitary Board met seven times in the course of the year when projects and estimates amounting to £14,000 for the improvement of the sanitation of municipalities were considered. The Board noticed with satisfaction the increased attention paid to the cleaning and protection of wells, and to the general improvement of the sanitary condition of the villages to which the Village Sanitation Act III of 1892 has been applied.

In the Punjab the municipal towns spent nearly 19 per cent. of their income on sanitation in the year 1900, or a little over 1 per cent. less than in the previous year. "In relation to sanitary progress generally," the Sanitary Commissioner states, "the province is improving. Endeavours are being made to supply every large town with a proper water supply and good drainage." **Punjab.**

Among the more important water supply and drainage schemes completed, in progress, or under consideration, were the extension of the Delhi waterworks, estimated to cost £12,000, the extension of the Simla waterworks scheme, and the improvement

of the water supply of Fort Dalipgarh in Bannu district. The water-supply scheme for the civil station of Dharmsala was still under consideration. Progress was made during the year with the Delhi drainage works, and, as far as completed, the drainage of the city is reported to be very satisfactory. The sewage works in Simla were well in hand; the drainage scheme for Fazilka in Ferozepore was progressing; and three separate projects for the improvement of the drainage of Lahore City were practically completed. Drainage works were also in progress in Rawalpindi, Hazro, and Abbottabad. The income derived from the sale of manure in all the municipal towns during the year amounted to £10,800 against £9,850 in 1899. Village sanitary note-books were in use in every district of the province, and they are reported to have proved useful. A new Sanitary Inspection note-book has been drawn up by the Sanitary Board.

The Sanitary Board held two meetings during the year when their attention was given to measures for the encouragement of improvements in village sanitation and matters in connection with the vital statistics of certain towns which have been supplied with drainage systems and waterworks, and where, *primâ facie*, improvement in the public health has not been exhibited. In the course of the year a sanitary engineer for the province was appointed.

Burma. No sanitary works of any importance were undertaken in Burma during the year 1900. The 41 municipal towns spent 55 per cent. of their income on sanitation, or 21 per cent. more than in the previous year. Prome was the only municipal town where anything appreciable was expended on water supply or drainage. Since the laying on of the river water, which is unfiltered, this town has greatly improved in health, and a system of drainage is now in progress. Schemes for the extension and improvement of the water supply of several towns were under consideration during the year, and that for Rangoon, which is estimated to cost about £73,000, was to be taken in hand without further delay. The Sanitary Engineer submitted water-supply schemes for several towns, chief among them being schemes for Moulmein, estimated to cost about £57,000, and for Meiktila; the drainage scheme for the latter has been completed. On rural sanitation a sum of over £12,000 was expended during the year from District Cess funds. The Sanitary Commissioner with the Government of India remarks: "While much actual achievement has not marked the year under review in regard to large sanitary works in either urban or rural areas, there is evidence of awakening on the part of the responsible authorities, and the next few years should see many useful and important projects completed."

Proposals for the re-organization of the Sanitary Board were submitted to Government during the year.

Central Provinces. The municipalities of the Central Provinces spent a little over 28 per cent. of their income on sanitation in the year under notice, or about 10 per cent. less than in 1899. This is hardly to be wondered at considering the terrible famine which prevailed throughout the province. Little was done in fact except what was accomplished in the way of improving the water supply by famine labour. The most important works in this direction were in Nagpur and Khandwa, in both of which places there was reason to fear that the supply of water might be insufficient. The Bhandara works were completed and progress was made with the Harda water-works.

Owing to the special circumstances of the year, no meetings of the Sanitary Board were held. "In several districts the work of Sanitary reform was," the Sanitary Commissioner observes, "on account of the general distress and consequent paucity of funds, much curtailed, while in some others it was brought to a standstill."

Assam. Excluding four towns which have no separate incomes of their own, the municipal authorities in Assam spent nearly 45 per cent. of their income on sanitation in the year 1900. No extensive sanitary work was undertaken during the year, and no provincial scheme of any importance was under consideration, but in almost all municipalities small sums were spent on improvements to the drainage and water supply systems. The sanitary improvements effected by Local Boards were chiefly in the direction of providing a purer water supply by the construction of masonry wells and the excavation of tanks at some of the larger villages. Sanitary inspection books were kept up in selected villages, but owing to a lack of interest in sanitary matters on the part of the village officials the books are in many cases of little value.

The Sanitary Board held three meetings during the year.

In Madras city a sum of £59,000 was expended on sanitation during the year, the chief item being £45,000 on miscellaneous sanitary works, while only £1,761 were spent on conservancy, and £1,454 on water supply. The Mylapore drainage system continued to give satisfaction, and progress was made with the new drainage scheme for the city during the year; the first two miles of the cast iron main were laid in the 1st Division. The work done by the incinerator corresponded closely with that in the previous year, and over 33,000 cartloads of rubbish were consumed. Two more incinerators were in progress. The quantity of water supplied from the Red Hills Lake was about 2 per cent. greater than in the previous year; but the level of the lake was lower at the close of the year than at the beginning; the lowest level (32·18) was in October. Madras.

In the Madras Presidency the district municipalities allotted about 60·6 per cent., and the district boards 5·3 per cent. of their income for sanitary purposes. A large portion of this expenditure was on conservancy, but the allotment out of municipal incomes for water supply altogether amounted to £40,260 in addition to that of Madras city. The Sanitary Commissioner reports that "the question of conservancy of towns is steadily receiving more attention from local bodies, whilst the various methods of biological purification of sewage are likely to become popular. The people, especially, realize the convenience of using household sewage filters." The programme of sanitary engineering for the year contained water-supply schemes for Berhampur, Tiruvannamalai, which were completed and submitted to Government, and for Negapatam and Calicut; and a drainage scheme for Madura. Besides these, plans and estimates were drawn up for schemes of water supply to five other towns and for the complete drainage of Ootacamund. Improvements to the Trichinopoly water supply were commenced and completed. The sanitary works undertaken and carried out by local boards during the year consisted in the sinking and repairing of wells, construction and repair of tanks, latrines, drains, &c., and the improvement of village sites and water supply generally. Village sanitary inspection books were in general use in nearly all the districts.

During the year the Sanitary Board scrutinized the plans and estimates of 108 sanitary works, 20 of which were for municipalities, 87 for Local Fund Boards, and one for the Public Works Department. The total estimated cost of these projects amounts to over £20,000.

In Bombay city the works executed or in progress in the Special Drainage Department during the years, included, amongst others, the ovoiding and constructing of masonry side drains, the construction of storm water drains in various parts of the city, and the construction of the Mazagon sectional sewerage works. The Corporation sanctioned the construction of certain works, to cost about £90,000, for the drainage of the lower parts of the city. Early in the year the Corporation passed a resolution expressing opinion that the work of house connections should be pushed on with as great a rapidity as may be compatible with efficiency, and the street portions of house drainage connections carried out numbered 6,002, at a cost of about £9,300. Although the rainfall at the Tansa lake was considerably greater than in the previous years, and the quantity of water received in the lake was much in excess, yet, owing to the early cessation of the rains, the lake fell to the lowest recorded level. The total number of water connections in the city was 20,394, of which 190 were made during the year. Bombay.

In the other municipalities of the Presidency about 21 per cent. of the income was spent on water supply, drainage and conservancy, and under the same heads the local boards spent 7 per cent. of their income. The large expenditure on plague precautions again checked the prosecution of sanitary works. The only works of any importance carried out were the enlargement of the Karachi waterworks and the deepening of the Pokhran tank in Thana, and of the Athin tank in Belgaum. The Bombay Village Sanitation Act was introduced into one other village during 1900, making a total of 301 villages now under its provisions. The Act provides for the establishment of a sanitary committee or a sanitary board, consisting of members chosen by the collector of the district or by the Local Government, to supervise sanitary matters; but it would appear that owing to famine and plague no progress was made during the year in the establishment of committees under this Act. Village sanitary inspection books were in use in 3,356 villages.

The Sanitary Board gave advice concerning several projects, including the Poona drainage and water supply projects, which were finally approved by the Government

of Bombay, and were before the Governmemt of India, as they involved the grant of loans on liberal terms to the local authorities. Plans for the Kaira and Mehmadabad water-supply schemes were prepared by the Board.

Berar. The municipalities of Berar spent 45 per cent. of their income on sanitary improvements in 1900. No new works of importance were in progress during the year, as expenditure on sanitary purposes had to be seriously curtailed owing to the cost of famine works and the adoption of preventive measures against plague. The District Sanitary Boards met once at each of the six headquarter stations during the year to take stock of the action taken on the suggestions made by the Sanitary Commissioner in his survey remarks on the several towns and villages surveyed in past years. Not much progress was made during the year in the sanitary survey of selected towns and large villages; no towns were surveyed, and only 135 villages. There still remain two towns and 3,981 villages to be surveyed.

India Office,
November, 1902.

ABSTRACTS

OF

SANITARY AND OTHER REPORTS

FOR

1900

ABSTRACT OF THE REPORT OF THE SANITARY COMMISSIONER WITH THE GOVERNMENT OF INDIA.

(*Surgeon-General B. Franklin, I.M.S.*)

European Troops.

Sickness and Mortality in 1900.—The health of the European army of India, though unfavourably affected as to mortality by the epidemic prevalence in India of cholera, bowel complaints, small-pox, and malaria, was as to sickness better than in the previous year; the increase in mortality and invaliding, however, somewhat outweighing the decrease in sickness.

Years.	Average Strength.*	Ratio per 1,000 of Strength.				
		Admissions into Hospital.	Constantly Sick.	Deaths.	Invaliding.	Total Loss.
1896–1900... ...	66,974	1,339	86	17·08	33	50
1899	67,697	1,149	73	12·75	32	45
1900	60,553	1,143	72	14·62	33	48
1891–1900... ...	68,224	1,399	87	16·21	29	45

*The quinquennial and decennial ratios are, of course, worked on the total strength of the lustrum and decade respectively.

The chief causes of admission were ague and venereal diseases. Among the diseases with increased admission rates were cholera, small-pox, and malarial fevers. On the other hand, the admission rates from influenza, respiratory affections, enteric fever, simple continued fever, and venereal diseases were lessened. Ague and venereal diseases caused respectively 27 and 26 per cent. of the total sickness.

The chief causes of death were enteric fever, and then hepatic abscess and cholera. Among the diseases with increased mortality were cholera, small-pox, malarial fevers, dysentery, diarrhœa, and hepatic abscess. On the other hand, the mortality from enteric fever and pneumonia was lessened. Enteric fever caused 33 per cent. of the total deaths, hepatic abscess 11 per cent., and cholera 10 per cent.

The chief causes of invaliding were, in order, syphilis and gonorrhœa, debility, malarial fevers, disordered action of the heart, tubercle of the lungs, and valvular disease of the heart.

The chief causes of admission in the China Field Force were ague, dysentery, venereal disease, and diarrhœa, and the chief causes of death enteric fever and dysentery.

Commands.—In the following table the ratios of the four commands are placed side by side for comparison. Madras was the most unhealthy of the four commands, Bombay coming next, and both being more unhealthy than in 1899. Bengal had the highest mortality from tubercle of the lungs, dysentery, and abscess of the liver; the Punjab from remittent fever, heatstroke, and pneumonia; Madras from cholera, ague, and dysentery; Bombay from small-pox, enteric fever, and diarrhœa.

Stations.—The highest death-rates among stations of over 100 strength were those of Fort Lahore, Barrackpore, Delhi, Neemuch, and Nasirabad; and the highest among stations of over 1,000 strength those of Secunderabad, Meerut, and Mhow. In all these stations cholera was a factor in the mortality. In addition there were high ratios at Barrackpore from hepatic abscess, dysentery, and enteric fever; at Delhi and Neemuch from enteric fever and dysentery; and at Nasirabad, Secunderabad, Meerut, and Mhow from enteric fever. All the stations mentioned had greater mortality than in 1899.

Ratios of Commands.

	Ratios per 1,000 of the Average Strength.				
	Bengal Command.	Punjab Command.	Madras Command.	Bombay Command.	India.
I.—Strength	18,956	16,562	9,984	15,051	60,553
II.—Constantly Sick-Rate of the Year	69·9	64·9	82·0	74·7	71·7
III.—Admission-Rate of the Year—					
Influenza	8·4	1·5	4·5	·5	3·9
Cholera...	1·1	1·4	2·5	2·5	1·8
Small-pox	·2	·2	·5	1·6	·6
Enteric fever	12·8	15·5	11·7	23·5	16·0
Intermittent fever	269·0	336·2	321·0	319·4	308·5
Remittent fever	16·9	13·2	10·5	8·1	12·7
Simple continued fever	33·9	10·6	22·9	28·6	24·4
Tubercle of the lungs	3·3	2·7	2·8	4·7	3·4
Pneumonia	3·7	5·0	1·8	3·7	3·7
Other respiratory diseases	17·9	21·9	23·7	23·4	21·3
Dysentery	25·7	17·8	32·3	30·4	25·8
Diarrhœa	17·5	17·4	3·2	30·7	18·4
Hepatic abscess	2·6	1·7	3·1	3·1	2·6
„ congestion and inflammation	16·2	14·0	24·5	15·0	16·7
Venereal diseases	299·9	235·8	354·4	327·0	298·1
All Causes	1,074·6	1,085·1	1,268·1	1,210·8	1,143·2
IV.—Death-Rate of the Year—					
Cholera...	·95	1·15	2·10	1·99	1·45
Small-pox	—	—	—	·20	·05
Enteric fever	3·64	4·35	4·71	6·71	4·77
Intermittent fever	·37	·97	1·10	·40	·66
Remittent fever	·16	·24	·20	·07	·17
Simple continued fever	·05	—	—	·07	·03
Heatstroke	·74	·78	·70	·40	·66
Circulatory diseases	·42	·30	1·20	·53	·54
Tubercle of the lungs	·74	·54	·30	·60	·58
Pneumonia	·26	·72	·30	·27	·40
Other respiratory diseases	·05	·06	·20	·13	·10
Dysentery	1·00	·60	1·00	·86	·86
Diarrhœa	·05	0·6	—	·07	·05
Hepatic abscess	1·95	·97	1·50	1·79	1·57
All Causes	13·40	12·62	16·53	17·08	14·62

Geographical Groups.—The following table shows that, judging by the constantly sick rate, Gangetic Plain and Central India were the most unhealthy groups for the decennium, and the Hills and Western Coast the most healthy. The highest decennial admission ratio for cholera was in the Gangetic Plain, for enteric fever in the Hills, for ague in Indus Valley, for pneumonia in Indus Valley, and for dysentery in Bengal-Orissa. Only for dysentery was the relation the same in 1900. An examination of the figures of the longer period for European troops, native troops, and prisoners, shows that for all three influenza was least in Western Coast, ague in Southern India, venereal disease in Indus Valley; and small-pox most in the Deccan, pneumonia in Indus Valley, and dysentery in Assam and Bengal-Orissa.

Ratios of Geographical Groups.

	Ratios per 1,000 of the average strength.												
	I. Burma Coast and Bay Islands.	II. Burma Inland.	IV. Bengal and Orissa.	V. Gangetic Plain and Chutia Nagpur.	VI. Upper Sub-Himalaya.	VII. North-Western Frontier, Indus Valley, and North-Western Rajputana.	VIII. South-Eastern Rajputana, Central India and Gujarat.	IX. Deccan.	X. Western Coast.	XI. Southern India.	XII*a*. Hill Stations.	XII*b*. Hill Convalescent Depôts and Sanitaria.	India.
I.—Strength	1,047	1,723	2,153	5,748	11,105	4,628	6,003	9,358	1,491	2,069	8,874	3,247	60,553
II.—Constantly Sick-Rate of the Year	79·1	101·5	75·4	70·2	73·8	65·8	89·3	74·1	53·1	71·5	53·3	78·7	71·7
III.—Admission-Rate of the Year:													
Influenza	14·3	—	50·6	4·9	·8	—	1·0	3·1	7·4	3·9	1·2	3·4	3·9
Cholera	—	—	1·4	1·2	2·8	·2	3·5	4·1	·7	·5	—	·9	1·8
Small-pox	—	—	—	·2	·3	·2	1·7	1·8	1·3	—	—	·3	·6
Enteric fever	8·6	2·3	6·5	19·0	12·8	14·7	25·2	20·5	5·4	5·3	24·1	10·2	16·0
Intermittent fever	207·3	849·1	403·2	248·4	444·2	372·9	384·5	202·6	124·1	277·4	105·5	255·0	308·5
Remittent fever	—	16·8	95·7	8·0	8·6	21·4	10·0	9·6	3·4	15·5	6·6	6·2	12·7
Simple continued fever ..	18·1	2·3	27·9	65·8	12·3	16·2	18·7	48·1	14·8	22·2	8·5	13·9	24·4
Rheumatic fever	—	·6	·5	·2	1·1	1·5	1·0	·6	—	1·9	1·2	·3	·9
Tubercle of the lungs ..	1·9	1·7	4·2	3·8	3·7	3·9	1·2	2·0	6·0	3·9	1·7	3·1	3·4
Pneumonia	1·0	3·5	6·5	3·1	4·9	8·0	4·0	1·6	1·3	1·0	3·2	4·3	3·7
Other respiratory diseases	31·5	28·1	28·3	16·5	23·5	29·0	22·3	16·9	18·8	22·2	14·2	31·1	21·3
Dysentery	43·0	22·1	57·1	20·7	23·1	14·0	34·3	37·0	26·2	19·8	12·2	18·2	25·8
Diarrhœa	—	1·7	21·4	12·9	19·5	21·6	38·0	12·7	8·7	4·8	21·5	17·6	15·4
Hepatic { abscess	8·6	1·7	4·6	3·3	1·5	1·1	2·3	2·0	5·4	3·4	1·9	2·8	2·6
Hepatic { congestion and inflammation.	45·8	28·4	25·1	15·5	14·0	12·1	15·5	13·0	14·8	16·9	11·8	39·7	16·7
Venereal diseases	429·8	309·9	281·0	287·6	252·9	240·3	443·9	375·9	261·6	392·0	230·9	250·7	298·1
All Causes	1,273·2	1,672·1	1,365·8	1,057·1	1,243·6	1,172·6	1,396·5	1,160·5	781·4	1,286·1	726·5	1,127·5	1,143·2
IV.—Death-Rate of the Year—													
Cholera	—	—	1·39	·87	2·43	·22	2·67	3·53	—	·48	—	·62	1·45
Small-pox	—	—	—	—	—	—	·33	·11	—	—	—	—	·05
Enteric fever	3·82	1·16	4·18	4·00	3·60	6·05	7·83	6·95	4·02	2·90	4·96	2·46	4·77
Intermittent fever	2·87	4·06	·93	—	1·26	·65	·67	·11	—	·48	—	·92	·66
Remittent fever	—	—	—	·17	—	·65	·33	·11	—	·48	—	·31	·17
Simple continued fever ..	—	—	—	—	—	—	·17	·11	—	—	—	—	·03
Heatstroke	·96	·58	·46	·52	1·17	·65	1·33	·32	1·34	·97	—	—	·66
Circulatory diseases ..	—	4·06	—	·52	·63	—	·50	·64	—	·97	·34	·31	·54
Tubercle of the lungs ..	·96	—	·93	·35	·63	·65	·33	·32	2·01	·48	·23	1·54	·58
Pneumonia	—	·58	·46	·17	·81	·65	·17	·32	—	—	·34	·31	·40
Other respiratory diseases	—	—	—	—	—	—	—	·21	·67	—	—	·92	·10
Dysentery	1·91	—	4·18	·70	·90	·22	·67	·96	1·34	·48	·23	1·85	·86
Diarrhœa	—	—	—	—	·18	—	—	—	—	—	·11	—	·05
Hepatic Abscess	4·78	1·74	4·18	2·09	1·08	·43	1·67	1·28	4·02	1·45	1·24	2·46	1·57
All Causes	22·92	15·67	19·97	12·87	15·40	12·73	20·82	16·99	14·76	11·60	8·45	14·78	14·62

Influenza.—The absolute and proportional amounts of influenza fell greatly. The admissions, which had fallen at the end of 1899, began to rise in February, reached a maximum in June and a second, somewhat higher, in September, and then fell to the end of the year. The first epidemic year was 1890. The actual maximum of the individual years of the eleven occurred in various different months, but over the eleven year period as a whole the greatest numbers of cases occurred in April and March, and the smallest numbers in August and September. Groups IV, VIII, and X were affected in 1900, but not in 1899; while Groups II and VII, which had been affected in 1899, escaped in 1900. The other groups containing British troops were affected in both years. Twenty-two stations returned cases against twenty-eight. The highest numbers were at Barrackpore, Dum-Dum, and Lucknow. In Barrackpore the disease attacked only the British troops, was severe in type, sometimes resembling scarlet fever, often left behind great prostration, caused two men to be invalided, and in two cases was followed by abscess of the liver.

Cholera.—The amount and proportion of cholera was much greater than in the previous year, the admissions having risen from 1 to 107. At Secunderabad, where the highest number of cases occurred, cholera was prevailing in the city and surrounding villages almost as soon as the monsoon began; and, though all infected places were put out of bounds, and native cooks dismissed, cholera of a virulent type attacked all the corps in barracks, except the Artillery, of which, however, two men in hospital were attacked. In the case of the other stations also with comparatively high numbers, it is mentioned that the disease was prevalent in the civil population; and it is believed that but for the precautions taken, the troops would have suffered more severely. Some of the famine tracts were areas of special danger. The ratios were less than in the native troops and prisoners. Four (non-fatal) cases of "epidemic diarrhœa" were returned from a cholera camp at Shalimar, near Lahore and Meean Meer.

Small-pox.—The admission rate from small-pox was three, and the death-rate five times greater than in the preceding year; and the admissions and deaths were 36 and 3 against 14 and 1. The disease was prevalent in the country, and here, again, the influence of the famine was unfavourable. The highest number of cases was 10 at Kamptee. No other station had more than 3 cases, and no station had more than one death. The Deccan had most small-pox.

Ague, remittent fever, simple continued fever.—Ague gave rise to nearly 27 per cent. of the admissions from all causes. Both the admission and the death-rates were raised, and the increase, where it was greatest, was usually ascribed to unusual rainfall and floods. The greatest outbreaks were those at Ferozepore and Fort Dufferin (Mandalay). At Ferozepore the increase, gradual at first, became explosively sudden in October, and the type of the disease altered for the worse, many of the patients exhibiting alarming symptoms, though few died. At the same time mosquitoes were unusually abundant and troublesome, and *anopheles* was found in barracks, bungalows, and hospital. The women, children, and bandsmen returning from the hills were all attacked; and from their cases it was judged that the incubation period of the disease is about 14 days. The whole wing of the Oxford Light Infantry had to be sent to Kurrachee* for change of air, being completely prostrated and incapacitated for duty. The other classes of the population also suffered. At Mandalay the men of the 2nd Durham Light Infantry, stationed within the walls of Fort Dufferin, suffered severely, while the artillery, stationed near Mandalay Hill, were "practically free." This is said to be due to the infantry barracks being situated in a marsh, not capable of being rendered habitable by drainage, "a locality so notoriously unhealthy that in King Thebaw's time the place was abandoned by the Burmese." About 350 men of the regiment had to be sent away to healthy stations for change, and at last the regiment had to be sent out of the country to Wellington. Some of the troops at Aden had come from malarious stations in India, but the Isthmus Position was considered to be an undoubted local source of malaria, especially after a heavy rainfall in February, and had to be evacuated for the second time in ten years with good effect to the health of the men. It is said to be low and damp, so that one inch of rain is enough to turn it into a marsh. The finding of *anopheles* was recorded also at Delhi, Roorkee, Agra and Deesa On the other hand, it is said to have been rare at Rawalpindi, and not to have been found at Colaba, though it is stated that it is common in some other parts of Bombay, especially Malabar Hill; and in the room at Bangalore, occupied by the company chiefly affected,

* This, of course, affected unfavourably the health statistics of Kurrachee.

only *culex* could be discovered. In the hospital at Nowgong two cases of fresh infection occurred in a ward on the ground floor. In front of the ward there was a small masonry tank, from which the garden was watered, and this was found to be a haunt of *anopheles*. The tank was cleared out, and the patients removed to the upper floor, and no further cases occurred in hospital. The prophylactic use of quinine was found disappointing at Ferozepore, Mandalay, and Nasirabad; of doubtful benefit at four stations; but good at nine. In cases of apparent failure, present knowledge would indicate, not the stoppage of the issue, but an endeavour to find the cause of the failure, so that it might, if possible, be removed or avoided.

There was also, naturally, an increase in remittent fever. The monthly distribution was not quite the same as that of ague, but there seems no reason to doubt the correctness of the opinion of medical officers that in most cases the disease was malarial. The highest numbers were at Fort William, Peshawar, and Rawalpindi. There were no cases in the Ferozepore malarial outbreak, described above, and only 11, none fatal, at Mandalay.

There was a reduction in simple continued fever. The most frequent causes assigned for the attacks were high air temperature, exposure to the sun, especially if combined with fatigue, digestive derangements, and chills. Any definite fever which seemed to be neither malarial nor enteric was so returned. It was suspected that some cases might have been mild enteric fever or influenza; and some of the cases at Calcutta suggested Malta fever, though no case of Malta fever was returned anywhere in India. The probability was entertained that some cases were really malarial, and the rise in October seems to support this idea. The results of post-mortem examination in the two fatal cases did not show that any error in diagnosis had been committed; and the deaths were considered to have been accelerated by the very high atmospheric temperature prevailing at the time. A re-action, supported to some extent by the results of serum testing, has set in against the extreme opinion that all cases of so-called simple continued fever are in reality cases of enteric fever.

Enteric Fever.

Water and the Bacillary Diagnosis in general. Filters, &c. Milk.—The riddle of the exact relation between the enteric and the colon bacilli is still unread; and, therefore, the bacteriological examination of water, among other things, is still in a state of uncertainty. Houston appears to think it safer in the meantime to acknowledge as enteric only those bacilli which respond to all the known bacteriological tests; while Chantemesse, Rémy, and others, have shown reason for believing that the enteric bacillus living in association with other micro-organisms may lose certain of its classical characters, but most frequently its specific agglutinating power; and it is not infrequent in the reports of water examinations to read of suspected bacilli which answered to all or nearly all the tests except the serum one. To show, according to Rémy, that a bacillus giving the cultural characters of the enteric bacillus, but failing to stand the agglutination test, is really the enteric bacillus, it is necessary to inoculate it into a guinea pig, and then with the serum of the animal to obtain the required specific re-action with an authentic culture of the enteric bacillus. Horrocks, on the other hand, in describing the discovery in water of coliform bacilli which could hardly be distinguished from the enteric bacillus by cultivation, but refused agglutination, states his opinion, one somewhat widely held, that a bacillus not agglutinated is certainly not enteric, but that a bacillus agglutinated by a moderately dilute serum is not necessarily enteric; while Houston has isolated from water a few colilike microbes, which were certainly not *Bacillus typhosus* and could not be classed as *Bacillus enteritidis*, yet which clumped in marked fashion with one or other or both sera. Again, Houston agrees with Horton Smith as to the fallacy of considering an unknown bacillus as Eberthian simply because it responds to the agglutination phenomenon, without seeing whether it answers to other tests for the typhoid bacillus; and Sternberg is of the same opinion, and also Hunter and Köhler and Scheffler. In view of the difficulty of separating the enteric from the colon bacillus, new processes are continually being devised. Cambier and also Gabritschewsky attempt to attain the end desired by utilising the greater motility of the enteric bacillus; while, with special reference to water, Chantemesse has introduced a method which consists in collecting the microbes from a considerable quantity of water, and then using an enrichment process. Others, despairing of being able to isolate small quantities of the microbe diffused in immense masses of water, have endeavoured to ascertain what commoner microbes might be regarded, when found in water, as signs of fæcal pollution. This matter has been referred to in former reports. In answer to the query whether the presence of the colon bacillus in water taken from a well

15 feet deep would justify one in stating in court that this was evidence of contamination by excreta, the *British Medical Journal* replied that no categorical answer could be given ; that the bacillus coli is an excremental organism, but is so ubiquitous that the reply must depend on the number of bacilli present, that is in what minimal quantity of the water at least one representative of the *B. coli* is present ; that if in the well in question the *B. coli* is found in 10 c. c. of the water or less, it is evidence of contamination, if in 10-50, contamination is dubious, if only in over 50 c. c., it is devoid of significance ; but that much depends on the method adopted for its detection. But Parkes declares that any sample which contains the colon bacillus in 50 c. c. should be condemned ; while Weissenfeld asserts that the colon bacillus is not characteristic for the fæces of men and animals, and will be found present in all water, if enough is examined. By an ingenious application of his own observations Horrocks seeks to get over the difficulty. He found that as regards reaction to antityphoid horse serum the varieties of the colon bacillus isolated from typhoid stools showed much greater sensibility to agglutination than the varieties of the same bacillus isolated from healthy stools ; and therefrom draws the conclusion that if varieties of the colon bacillus isolated from a water-supply are found to be agglutinated by antityphoid horse serum in 1·500 dilution, there appear to be reasonable grounds for the assumption that the water-supply in question has been fouled with specific dejecta from cases of enteric fever. The success of this test would probably depend on the length of time the bacilli had been in the water. The whole subject is lucidly reviewed by Houston. In India the opinion of Hankin is well known, that pure water, from the absence of competition, suits the enteric bacillus, and that the infection of a pure water-supply is therefore particularly dangerous ; and Wanklyn has stated that the most dangerous water is one highly charged with organic matter, but almost free from organisms. So, Johnston mentions, that Jordan of Chicago has kept the enteric bacillus alive for 93 days in sterilized Lake Michigan water. Again, Groves quotes Frankland's experiments in which the enteric bacillus ceased to be infective in 5 days in river water which contained millions of organisms in the c. c., but remained infective after 35 days in deep well chalk water containing less than 150 in the c. c. Houston mentions that while most continental observers are of opinion that the typhoid bacillus loses its vitality somewhat rapidly in unsterilized potable waters, Klein's results indicate that the distinction has been overlooked between a great decrease in number and total disappearance. By paying attention to this point Klein was able to show that some typhoid bacilli persisted in unsterilized water long after the majority had perished. Cases in which the infection seems to have survived travel in the volume of a river in company with other microbes and to have then originated outbreaks in towns miles down the river have been reported by Fosbroke at the Cheltenham meeting of the British Medical Association, and by Jownston, Mills, and others at the Michigan Conference of Medical Officers of Health. Besides detailing the proofs that the infection was so carried down stream, Johnston states that the Massachusetts Board of Health took Merrimac River water and experimented with it, and found that typhoid germs would live in it 25 days, long enough for them to be carried 685 miles down the Merrimac River. And Mills remarks that hitherto it has been taken for granted that polluted water poured into a running stream becomes purified within a short period of time : but that this is now questioned, and it is believed by many that the germs of typhoid fever have been carried long distances by flowing streams, as from Port Huron to Detroit, a distance of 60 miles. Some new instances have occurred of the use to which the purposive or accidental admixture of yeast, absinthe, or fluoresceine has been put for the detection of the source or course of a water. The *British Medical Journal* in a leading article on the Waste of Life and Efficiency in South Africa remarks that the exact proportion between waterborne infection and infection by other means—infected dust clouds, flies, &c.—cannot be stated, but that, as a working and probable hypothesis, it might be assumed that in half the cases the infection is waterborne ; that in one-fourth it is carried by specifically contaminated dust or by flies ; and that in another fourth there is direct personal infection. Again at the Michigan Conference, Riggs brought forward the statistics of the alleged causation of 31,264 cases of enteric fever, derived from the reports of the Michigan State Board for 10 years, and after studying them, concluded by saying that he believed that a careful study of the disease based on full and complete reports would show that 90 per cent. of all cases are directly or indirectly traceable to contaminated water, and that a further analysis would trace the source of this contamination to sewage, garbage, cesspools, &c. ; and in this connexion it may be pointed out that Parkes and Kenwood, in noticing Klein's results as to the very

favourable medium which nitrate sewage presents to the enteric bacillus, remark that crude sewage is, as a rule, free from nitrates, whilst sewage that has been filtered through soil contains nitrates as a result of oxidation, which may be the reason why well-waters polluted by drain or cesspool leakage through the soil have the capacity, apparently, of retaining for considerable periods the infective properties introduced by the specific pollution. Leigh Canney in polemical writings or papers has contended for the supreme pre-eminence of water as the vehicle of the infection; and believes that enteric fever will have to be met and overcome, in no matter what part of the world, on the waterborne theory mainly, though without neglecting other avenues of infection. On the other hand, Professor Victor Vaughan, at the Michigan Conference at Grand Rapids, stated that he had been in the habit of saying to his students, until a year ago, that 90 per cent. of the cases of enteric fever were through infected water, but that he would not say so now; he believed that enteric fever in civil life is largely disseminated through the drinking water; but in military life it is often spread by other means, such as dust and flies. Washbourne agrees with Canney that epidemics of enteric fever are waterborne and not airborne, but believes that sporadic individual cases are infected otherwise than by water. So, Barr remarks that pure water-supply has abolished widespread epidemics; but that as an endemic, enteric fever is as prevalent and of as severe a type as it was a quarter of a century ago; and Parkes and Kenwood that it is the experience of numerous places that enteric fever may be endemic, notwithstanding a water-supply of undoubted purity. With regard to India it may be said that the medical officers on the spot seldom believe in any exclusive water theory, and that they have advanced good grounds for their opinions. As to filtration, Fuller, the New York Consulting Expert, insists that it is of prime importance to know the individuality of a water as a first step towards its successful purification, in order that the processes associated with filtration, such as storage, subsidence, coagulation, and aëration, may be properly considered. Houston reminded his hearers that though efficient sand filtration is a great safeguard, there is no reliable evidence to show that it more than greatly lessens the danger; and that filters on the small scale are usually untrustworthy. Horrocks states that if there are no flaws, the enteric bacillus cannot get through the walls of the Pasteur-Chamberland filter; but that it can get through the Berkefeld in from 4 to 11 days, so that the candles have to be boiled every third day. Munson's opinion that both the Berkefeld and the Pasteur-Chamberland filters, if given proper care, serve an excellent purpose in fixed camps or garrisons, but that the difficulties attending their liability to clog or break and the necessary periodic sterilization are such as to render them often a trouble rather than an advantage in the field, is confirmed by experience; but even in fixed sites, such is the care required that they are sometimes not a success. The Waterhouse-Forbes water sterilizer is described by Munson, who considers it the best form of heating sterilizer. It was favourably reported on in America by a board, which found that a single apparatus would suffice for the needs of two companies, or, where storage of water was possible, of a battalion; and also at Netley. It may be of interest to note that the frequently extolled Schumburg bromine process is reported by Schüder to be unable to accomplish the destruction of the enteric bacillus in water.

Klein has shown that milk is a better medium for the enteric bacillus than cream, and cream than cheese.

Soil, dust, flies, direct infection.—S. Martin continuing his experiments under circumstances more favourable to the microbe than before, found that the enteric bacillus died out in unsterilized soil within 12 days, owing to the antagonism of the soil micro-organisms. Mentioning these results and taking into consideration some of his own, Houston comes to the conclusion that surface soil is unfavourable to the growth and vitality of non-sporing microbes of intestinal origin, though he desires to speak with great caution on the subject, in view of the puzzling features connected with the endemic and epidemic prevalence of enteric fever in certain localities. Rullmann was able to recover the enteric bacillus from unsterilized earth after 100 days, and notes that the length of survival depends on the chemical composition of the soil. Vaughan is of opinion that the German experiments prove that the bacillus can be destroyed by drying, but not that the disease is not airborne or may not be so, and gives some practical reasons for believing that it is spread in this way; and Tooth, Church, Chiene, and others were impressed with the probability of this mode of dissemination in South Africa; but Sir Charles Cameron appears to be alone in thinking that it may almost be said that the disease is generally airborne. Houston, on the other hand, finds it difficult to believe that a non-sporing bacillus of comparatively speaking delicate sort can remain dormant for

long periods, neither multiplying nor dying, in the form of dust ; though he agrees that excreta and particles of soil and the fluff of soiled linen may, when the specific contamination is comparatively recent, be brought into relation with articles of food or drink in the form of dust. A very interesting observation is recorded by Vaughan, in which when lime had been sprinkled over the contents of the latrines, a short time afterwards flies could be seen with lime on their feet crawling over the potatoes or meat and bread that the men were going to eat ; and Simons quotes another American case in which the use or non-use by three bodies of men of fly-proof cages for their provisions, seemed to determine attack or non-attack ; and relates an experience of his own in which soil specific contamination acted directly in the winter and by means of flies in summer. Finally, Howard in America found that it is only diptera which go to human excrement, in all 77 kinds, of which 36 feed upon it. It appears to be generally acknowledged that the disease is frequently communicated by personal intercourse, and fresh instances have been adduced by S. Murphy, Handford, Gualdi, Kruse, and Guinon. Vaughan says that it can be carried on the hands, under the finger nails, in the clothes or blankets, and impresses upon his hearers that it is a "fearfully infectious disease" ; and Houston that it needs to be remembered that the direct spread of infection from the sick to the healthy is no idle myth but a dangerous fact.

Urine and urotropine. Sputum.—It has been mentioned in former reports that the bacillus appears in the urine in about 25 per cent. of cases. In 12 cases Neufeld found the same proportion,* and observed the sudden onset of the bacilluria marked by clouding of the urine. Houston, while believing that the potentialities for evil of a convalescent with specific bacilluria are so great as to be almost inconceivable, and accepting the fact that a case may for months or even years be a manufactory and distributory of the morbific virus of the disease, a fact which may explain some puzzling features in the spread of the disease, is struck by the difficulty† of understanding why some places, after being visited by severe epidemic, may remain for long periods afterwards almost free from the disease, notwithstanding that probably many of the inhabitants are carrying about within their bodies the living germs of the disease, and that some of them are possibly discharging enteric bacilli broadcast in their urine. Handford has suggested that the bacilli excreted in the urine may not always be in a virulent condition. In a case of cystitis caused by enteric bacilli that had come from the kidney, Curschmann found that the bacilli excreted in the urine, so far as could be judged by agglutination, were not reduced in virulence. The routine exhibition of urotropine (see former reports) is advocated by Houston, as by Richardson, Horton Smith, Clifford Allbutt, and others ; but there are certain drawbacks to its use. For, while at least five cases of hæmaturia from its use have been reported, and Neufeld confirms the fact that the bacilluria is apt to recur, Schumburg states that the drug merely inhibits the bacillus, which can be found in a condition capable of activity in the urine cleared by the use of urotropine, and concludes that the urine voided by the patient should be disinfected with mercury perchloride. It is in cases with pneumonic complication, while the expectoration is coloured by blood, that the bacillus has been found in the sputum. Its presence may persist into convalescence, so that a man may be dangerous to others after he has apparently recovered.

Sewer air. Sewage. Nitrate sewage.—The investigations of Lewis and of Andrewes and Lawes have shown that sewer air and foul emanations from cesspools have probably no part in the direct conveyance of the fever. The search for the enteric bacillus in sewage is acknowledged to be almost hopeless ; but Houston has pointed out that, judging from the behaviour of other microbes which can be more easily isolated from sewage, there can as yet be no confidence felt that the enteric bacillus may not be contained in sewage effluent from biological process tanks. When the enteric bacillus is planted in sewage to which 1 per cent. of potassium nitrate has been added, it retains its vitality for a considerable period, and undergoes rapid and continuous multiplication. In media containing 4-5 per cent. of nitrate the enteric microbe is reported to grow almost like a blastomyces.

Non-Eberthian fevers. Widal's test. Enteric fever without intestinal lesions. The bacillus in the blood.—The occurrence of non-Eberthian enteric fever has long been suspected or recognised. Cases have been quoted in former reports, and the views of

---

*, Schüder in D. M. W. XXVII, page 762, reports five out of 22 ; and shows that for all examined and recorded cases the percentage is something under 30.

† See also Neumann in D. M. W. XXVII, page 769.

Durham were given on page 26 of that for 1897. Petruschky refers such cases to members of the coli group. Some fresh cases have been reported, by Firth in India, and by Kurth and Schottmüller in Germany. The morbific agents in Firth's cases were the bacillus of Gärtner and members of the coli group, in Kurth's bacilli differing from those of Eberth and of Gärtner, and in Schottmüller's a bacillus standing between the enteric and the colon bacilli. Such cases, if not recognised, might, of course, contribute to the number clinically diagnosed which fail to react, or react irregularly, with Widal's test. But the test may fail also when typical lesions are present, or when the bacillus of Eberth is found in the blood or organs, and it is occasionally positive in the absence of Eberth's bacillus. And Koch has lately acknowledged that the reaction is not absolutely specific. However, it is rumoured that he will shortly bring forward a new test for the presence of genuine Eberthian fever. Fresh cases without intestinal lesions have been reported by Stewart, Lazarus-Barlow, Weichardt, Guizzetti, and Barjon and Lesieur ; but the best recent commentary on the whole subject is that of Opie and Bassett, who, though unable to deny that enteric fever may occur without intestinal lesions of the intestine, consider much of the evidence furnished by the published reports as inconclusive. The case which led to their remarks did not run its course without intestinal lesions, but the circumstances were such as might have led less careful observers to return it as one without intestinal lesions. They point out that the Peyerian swelling probably frequently subsides without going on to ulceration, and that cases in which death occurs early in the disease can alone furnish conclusive evidence that lesions of the intestine have not been present. As the result of the examination of 15 cases Cole concludes that it is apparent that enteric bacilli occur in the blood with much greater frequency and during a much longer time through the course of the disease than was formerly supposed, and in six the bacilli were found in the blood before Widal's reaction was present. The results of Scholtz and Krause were similar. Others have also been successful in cultivating the bacillus from the blood and the roseola.

Prevention ; Inoculation.—As Houston remarks, the greater our knowledge of the channels of infection and modes of dissemination of the disease, the greater becomes the probability of preventive treatment ; the measures of prevention being vaccination, early diagnosis by means of Widal's test, protection of water-supplies and sterilization, filtration, etc. ; shielding all articles of food from objectionable contamination ; keeping conservancy, sewers, and drains in good order ; disinfection of the stools, urine, and soiled linen of enteric fever patients ; early recognition of bacilluria and exhibition of urotropine, which must have a most important influence in the future in controlling the spread of the disease. As Duclaux well says, the enteric bacillus becomes difficult of recognition once it has escaped into outer nature, and it is far better to destroy it when it leaves the body than to wait till it gets into the water. The opinions of medical officers as to the prophylactic results of inoculation are conflicting, and there are various difficulties in the way of obtaining, or obtaining at once, the accurate statistics required for the formation of a legitimate conclusion. Some of the unfavourable results may have been due to ignorance of the fact, which Wright has just discovered and published, that when the reaction produced in the subject of inoculation is very marked, there is at first an increased liability to enteric fever ; so that when enteric fever is prevalent, small doses should be used and mild reaction aimed at. The prophylaxis of enteric fever has been treated of in detail by Schjerning, Vaughan, and Munson.

Opinions of Medical Officers.—As was to be expected, a number of medical officers attribute the diminution of enteric fever to the absence of drafts from England, owing to the South African war. In a few cases it is stated that particular barracks or corps were more affected than others, or that the disease was equally distributed among them ; but in the majority of instances they appeared to be affected indiscriminately. At Agra 10 out of 19 came from two barracks that showed want of supervision and cleanliness, and little attention to the boiling and pinking of the water. No reason could be discovered at Nasirabad why, though cases came from nearly every barrack, eighteen came from numbers 12 and 18. Nowgong's cases were all in the North Staffordshire Regiment ; and none occurred in the battery, which had been longer in India, and had already suffered severely in 1898. Enteric fever at Thobba was confined to the Bedfordshire Regiment, which had rested one day at the Meean Meer Rest Camp, where the water was reported to be open to filthy pollution. At Aden the disease was almost confined to the Royal West Kent Regiment in the Crater Position, and this was considered to be due to the fact that that position was much more exposed to dust than Steamer Point. As usual, many cases had not been contracted in the stations in which

they were treated; and not infrequently, especially with cases in the Hill Stations, the infection had been acquired on the march. In many cases the origin of illness was ascribed to the partaking of unauthorised or unselected food and water at stalls, tea-houses, and refreshment rooms in the bazaars, cities, or villages; at segregation, rest, or practice camps; at manœuvres or on the rifle range; when out walking, shooting, climbing khuds, travelling by railway. Dirty irrigation channels are one of the dangerous sources mentioned. One case in the Dagshai military prison (a man who had been 125 days in confinement) was traced to the use of a dirty surahi; one man was believed to have ingested the infection by swallowing water while bathing in a dirty tank; another had been eating watercress bought from natives; while in two stations it is mentioned that men attacked had consumed unauthorised water because they objected to the taste or to the want of coolness of the boiled water. It is reported that the first six cases at Quetta appeared in the fife and drum band of the Wiltshire Regiment, after a big Christmas dinner, most of the food and drinks for which had been bought in the bazaar. At Dagshai two men were supposed to have got the fever through milk purchased from a filthy hawker; the Kasauli dairy was reported to possess every possible defect from a sanitary point of view; while with regard to Subathu it is stated that on the 10th May all milk was ordered to be boiled, and that the epidemic ceased within 14 days. Other sources of the disease were believed to have been—the occupation of contaminated sites; specific inoculation of the trenches by post-mortem washings or by the stools of ambulant cases, especially when the trenches were to windward and, from want of water, were not cultivated; the distribution of dust from such places by the wind; the laying down of dirty river sand in the horse lines, and carelessness in the protection of drinking-water there and elsewhere; insufficient conservancy staff, resulting in want of promptitude and completeness in the disposal of nightsoil; neglect, and consequent uncleanliness, of barrack cisterns; the use of specifically polluted municipal water for the manufacture of aërated waters in the city, while the troops were intended to get only specially protected and treated well-water; the use of leather pakhals; bhistis taking impure water from roadside pools and horse-ponds. Men were supposed to have been rendered more liable by exposure to sun, heat, bad drainage, &c., or by diseases that arise therefrom, such as simple continued fever and tonsilitis. In some instances it seemed clear that the first case or cases were imported. Among the circumstances from which *patients* dated their illness were overexertion, overheating, oversunning, fatigue, and chill from field days and manœuvres, or from bicycling; a long journey by train; getting wet and sitting in wet clothes; bad cooking or bad food; bad smells from latrines or gardens; getting food or drink from hawkers or in the bazaar; swallowing dirty water while bathing in a buffalo-tank; nursing a case of enteric fever. The medical officer in charge at Lucknow cannot understand why there should be little difference in the enteric fever ratio, though a fifth of the men were inoculated, though no drafts arrived from home, and though many men had been sent to the hills before the enteric fever season; and from Nasirabad his complaint is echoed. On the other hand, the comparative immunity of Wellington and Mandalay could not be explained, especially as in the latter the water-supply was bad and very liable to pollution. Fifteen medical officers ascribed the reduction in enteric fever to the absence or smallness of drafts, and one to the large number of young men sent to the hills early in the year, while one notes that the men, retained in India, had become more acclimatized. At Subathu the good new water-supply gets the credit. By various medical officers some of the following measures were believed to have been effectual—douching the latrines twice daily for a fortnight with perchloride of mercury; treating the wells, latrines, and urinals with permanganate of potassium and hydrochloric acid; cleansing cooking vessels and mussacks with potassium permanganate every morning; mounding the night-soil, and using it to manure india-rubber trees; closing manure and nightsoil depôts that lay to windward; discontinuing sewage irrigation; avoiding as much as possible the use of barracks that had given most cases in previous years; putting the bazaar out of bounds (Umballa, Poona, Nasirabad, Neemuch); using Pasteur filters; boiling or pasteurizing the milk; on receipt of enteric convalescents from another station, keeping them to a separate latrine and destroying their stools and urine by fire. The presence of a number of men inoculated is also mentioned as a possible factor in reduction. Some officers speak of a lower degree of heat, and of fewer flies and less dust in consequence of thunder storms. Bringing the troops up earlier in the year than usual was thought to have had a good effect at Chakrata and Landour. At Raniket there were no convalescents, fewer young men, cooler air, fewer flies, and less dust; while at Chakrata the garrison came up earlier than usual, contained fewer young men, and had marched from the plains by a new

route, thereby avoiding the suspected camps and wells of the old route, and used barracks and latrine to which special attention had been given. The dryness of the year and the saltness of the soil are mentioned at Kurrachee, but it is doubtful whether either of these would really have a favourable effect. The use of Widal's test is said to have reduced the number of cases to be returned as enteric fever. One medical officer thought that the stopping of pinking and boiling conduced to reduction of the disease, apparently because the water was less handled. The water-supply of four or five stations is distinctly stated not to have been concerned in the origin or spread of the disease. At Lucknow, Agra, and Kurrachee the intake of the water was not sufficiently protected; at Umballa, Meiktila, Mandalay, and Shwebo the water was very liable to contamination; at Poona distribution, treatment, and storage were all defective, and to the canal which brings the Poona water natives had free access in places, and could be seen washing themselves and their clothes in it; at Ahmednagar and Nasirabad the supply was deficient, as well as liable to pollution; at Kurrachee the pressure was insufficient, so that men got into the habit of keeping a receptacle below the tap, and dipping their vessels into that; at Roorkee the water contained excess of chlorides from having passed through polluted soil; at Agra the soldiers could get the bad municipal water in the city, though not in cantonments; at Nowgong and Agra, respectively, the dairy well and a sanitary camp well were found to be in an unsatisfactory condition; at a few stations pakhals were still in use; at some stations, such as Calcutta, Fort Allahabad, Agra, Madras, Wellington, Secunderabad, Thayetmyo, Nasirabad, and Aden, there was a double water-supply, one for drinking, and one for other purposes. Of the fifteen stations which mention the carrying out of water analysis, eight return the result as good, bacteriologically good, or chemically and bacteriologically good. The water at Quetta was found to be originally very pure, but a bacteriological examination, not completed at the time of report, suggested that contamination possibly took place in barracks, from leaky pipes. In the water of Roorkee and Nasirabad there was excess of chlorides. "A" Spring at Chakrata yielded the colon bacillus in August and November; and an enteric-like bacillus was found by Mr. Hankin in a specimen of the Baircha water from Mhow. The Chemical Examiner for Burma did not consider the Meiktila lake water fit for drinking purposes, and Captain Rost, I. M. S., is said to have isolated the enteric bacillus from it. At Agra the water was examined weekly by Mr. Hankin, who found the enteric bacillus in samples from No. 43 standpost and from the river Jumna in May, in a sample from number No. 43 standpost in July, and in a sample from No. 53 standpost in November, though in the last two instances the microbe reacted but feebly with serum. In 25 other samples of Agra water there was found a bacillus having many of the cultural characters of the enteric bacillus, but which did not react to the specific serum, and gave a yellow growth on potato. No enteric or enteric-like bacilli were found in wells Nos. 4 and 5 in the British Infantry lines, the wells from which the drinking water for the troops was drawn. No system of purification of water was employed at Barrackpore, Dagshai, and Rawalpindi; Peshawar used the Pasteur filter; but in most stations the water was subjected to the action of boiling, potassium permanganate, or alum, each process alone or in combination with one or both of the others. In a few stations stress was laid upon the danger of contamination from handling during or after the process; but this danger is minimised wherever the Larymore boiler and its accessories are introduced. In some aërated water factories great care was observed, not only with regard to the water to be aërated, but also with regard to the cleansing of the bottles with permanganated water, acidulated water, boiled water. It has not been possible to obtain correct statistics whereby to compare the incidence of enteric fever on total abstainers with that on non-abstainers. A few of the men attacked stated that they never drank plain water; and about 170 never drank milk, about 30 not even in their tea. At Quetta all enteric stools have for two years been destroyed by fire; and in the reports of several other stations similar destructions of the fæces or of the fæces and urine is mentioned: and, as all stations possess the means to do so, the process has probably been carried out in many unreported cases. From a few stations it is reported that the men have begun to do their own cooking. Several medical officers were convinced that flies were important agents in the dissemination of the disease. Thus, from Mhow it is reported that flies were very numerous, that ambulant cases of enteric fever occurred, and that the filth carts were not properly cleaned from want of water. Dust and duststorms were considered to have been spreaders of the disease in several stations, perhaps most especially at Aden and Quetta. The medical officer at Quetta is of opinion that efficient watering of the roads would do much to check the extension of the disease. On the other hand, it is pointed out that at Nasirabad there were no cases in June though duststorms occurred, while there were cases in

September in the absence of duststorms. In a good many hospitals the serum reaction of patients was tested, at some stations more systematically than at others, every case at Kasauli, for example, in the latter part of the season, that lasted more than two days being thus tested. In many cases both enteric fever and Malta fever were tested for. Cases reacting negatively were often put down as simple continued or as remittent fever, though in a few cases the diagnosis remained enteric fever. At Jubbulpore there appears to have been a case without intestinal lesions, and another in which there were only two small ulcers in the caecum. In nine cases enteric fever and dysentery were concurrent or closely connected in time of occurrence. In the Murree case the patient was convalescent from enteric fever, when dysentery developed, and was followed by abscess of the liver. At Chakrata abscess of the liver followed enteric fever in one case. Out of the 970 cases of enteric fever which occurred throughout the army of India in 1900, 27 are noticed as having declared themselves among patients in hospital or among attendants. Out of these, 8 were in hospital for early venereal disease (the secondary symptoms in one case running concurrently with the enteric fever); and 12 for other diseases; and 7 were attendants on enteric fever cases. Two men at Quetta suffered from second attacks, the first attacks having been in 1898; while at Chakrata one man is said to have suffered from his third attack in three successive years. At Khyragully, it is reported, one native follower suffered, and another who nursed him also contracted the disease, both recovering. The serum test appears to have been frequently used in the diagnosis of cases.

Enteric Fever in 1900.—There was again a great decrease of both morbidity and mortality from enteric fever. The admission ratio was the lowest that had been seen since that of 1888, though higher than in any of the years before that except 1886. Of the causes of decrease already mentioned probably the most powerful were the almost complete absence of drafts from England and the freedom from field service. But the reduction is not so great as might have been expected, had the great prevalence of the disease been entirely due to the supply of fresh susceptible subjects. And the statistical evidence shows that of late years men of the higher ages and of the longer periods of service have been attacked in higher proportion to their strength than formerly; which seems to mean that the virus of the disease is now more widely spread and virulent. With the resumption of the ordinary annual reliefs, this condition will probably go from bad to worse. Hence the protection of the individual men by inoculation would be valuable. Unfortunately the feeling with regard to that prophylactic is at present one of hope rather than of confidence. One hopeful measure which ought to be generally and thoroughly carried out is the routine disinfectant treatment, wherever it is possible, of all enteric fever patients from the beginning of the third week with urotropine, and the immediate redisinfection or destruction of the urine after it has been voided. It appears pretty clear that the water-supply as such is not always to blame, and equally clear that, even when the *supply* is pure, the virus must be frequently ingested in portions of water which have been casually contaminated after delivery, or which come from sources other than the pipe supply. And this local infectiveness which threatens the men through their water, is likely to be dangerous also through the food, and perhaps through the air.

Though it had no greater proportion of drafts than the others, the Bombay Command was the only one with a higher admission ratio than in 1899, due principally to the increase at Quetta, Poona, and Nasirabad.

There were 970 admissions and 289 deaths, against 1,392 and 348 in 1899. The average duration of a case was nearly 53 days; and the average number constantly sick 140·70, which being multiplied by 365 gives 51,355·50, the total annual loss of service from the disease.

Enteric Fever in the Geographical Groups.—Groups XIIa, VIII, V, and VI had, as usual, high decennial ratios of admission; and Groups II and X, and, to a less extent, I and IV, low ratios. In fact the coast groups seem to have least enteric fever. In 1900 all the groups except I were in ratio below their decennial average, the reduction being especially great in VI, XI, and V.

Enteric Fever in Stations.—Leaving out the small station of Taragarh, the highest ratios of 1900 were those of Nasirabad and Quetta. Certain points about these outbreaks have been mentioned above. There is a double, but insufficient, water-supply, exposed to contamination by flies and dust, at Nisirabad; and the men are apt to use the wrong supply because the boiled water takes long to cool. The highest decennial ratios were those of Sabathu, Cherat, Taragarh, Dagshai, Benares, Agra, and Lucknow; while low ratios were most common in Burma stations and stations near the sea.

Relation of Enteric Fever to Age and Length of Residence in India.—In 1900 the greatest liability to suffer and die from enteric fever was between the ages of 20 and 25 and in the first three years of Indian service. In 1899 the incidence of the disease had been less at all ages and in all periods of service than in the preceding year ; but in 1900 it was greater in all age periods except the second, and in all service periods except the first two. If the 24 years beginning with 1877 be divided into 4 periods of 6 years each, it will be found that for all the age periods from 20 to 40 the death ratios of the last are higher than those of its predecessors, and in some cases the increase is progressive through the lustra. Owing to a break in the system of record the results cannot be tabulated for periods of service in such detail, but, so far as they go, the results are similar.

Enteric Fever and Season.—In the decennium 1891-1900, so far as can be gathered from the non-calendar returns of the army, the maximum months for India as a whole were May, April, and August. But the maximum period differs in northern and in peninsular India. The bulk of the enteric fever at Quetta during six years has been from May, June, or July onwards to the end of November, 89 per cent. in the second half of the year ; while at Nasirabad admissions in the same period have been much more equally divided between the two halves of the year, 51 per cent. in the last six months. An attempt to connect this difference clearly with the meteorology has not been successful ; though it may be noted that the increase of mean temperature and the increase of range in the second-half of the year were proportionally higher in Quetta than in Ajmer (the nearest meteorological station to Nasirabad), while the increase of relative humidity and of rainfall were proportionally less. Quetta also exhibits a remarkable annual alternation of much and little enteric fever, the years of much enteric fever being 1896, 1898, and 1900 ; and 1901 appears likely to continue the alternation by being a year of comparatively little enteric fever. In contrast to this Nasirabad's enteric fever remained nearly constant from 1895 to 1898, but rose in 1899 and again in 1900. All endeavours, even with the kind help of the Meteorological Reporter, to connect these peculiarities with the available meteorological data have failed. Some attribute the outbreaks at Quetta to contaminated dust, others to contaminated water ; but the curious alternation just mentioned seems to indicate the existence also of some unknown factor. The wind records of Quetta have also been examined without result.

Plague.—In the European army of India there occurred 6 cases of plague with 1 death. There were 2 cases at Bangalore and Belgam, and 1 each at Aden and "on the march," the death happening at Aden. The man on the march contracted the infection in Belgam, and in all three stations the disease was present among natives. The man attacked at Aden was employed in the kitchen. At Bangalore one of the men attacked had up to the date of admission been keeping a native woman in one of the most infected streets in the Ulsoor district ; infection in the other case was supposed to have been contracted in some similar way ; and the medical officer considered it marvellous that more cases had not appeared, as the women the men went with were of a low dirty type, and lived in plague districts. No officers, women, or children were attacked.

Tubercle of the lungs.—There was a slight increase of morbidity and mortality from tubercle of the lungs. No remarks of general interest are made in the annual reports of the stations where most cases occurred. Flügge has recently published an important addendum to his previous work on the conveyance of tubercle infection through the medium of the air by means of cough-spray or sputum-dust. These experiments show clearly the great danger created by the patient and incurred by those in contact with him from ignorant or wilful carelessness, and justify the utmost hopefulness as to the adequacy of precise, scientific, yet simple, measures of prophylaxis.

Pneumonia and other respiratory diseases.—The admission rates and death rates from pneumonia were low as compared with the ratios of both the preceding year and the decennium. Indus Valley usually has the highest proportion ; but in 1900 Bengal-Orissa stood first, and this may be connected with the fact that Bengal-Orissa had more influenza than any other group, while Indus Valley returned none. January was the maximum month, and February came next. At Kurrachee the disease was attributed to a cold land wind in January, when the men were in camp.

Burma Coast had the highest ratio for other respiratory diseases, but Mhow, Rawalpindi, and Quetta were the stations which had most cases. Bronchitis was the most common of these affections.

Dysentery and diarrhœa.—Both the admission and the death ratios from dysentery rose, and medical officers of stations having many cases notice the severity of the type of the disease. Dysentery was, as usual, most prevalent in the Bengal-Orissa group ; but it was more prevalent in the Madras and Bombay Commands than in that of Bengal. The maximum month was August for India, Central India, and the Deccan, but not for Bengal-Orissa. By far the highest ratio was that of Barrackpore, where, the medical officer says, severe dysentery, very apt to be followed by liver abscess, prevails yearly. Something has been done to improve the drainage of Barrackpore, but it is reported that more requires to be done. Contaminated water from surface drainage is mentioned at Rangoon ; and at some stations damp, chill, and errors or carelessness as to food and drink are cited as contributory causes. In addition to these last, there is noticed at Neemuch the danger from the crowds of famine people wandering about.

In France Comte has lately emphasized the infectiousness of the disease, and attributed it to a coliform bacillus : while Lesage has isolated a balloon-shaped diplococcus from the blood, stools, sputum and organs of patient suffering or dead from dysentery. In a recent paper Flexner announces that he has had an opportunity of comparing in a thorough bacteriological manner the bacilli of Shiga, of Flexner, of Kruse, and of Strong, and has no doubt of their identity ;* "so that the justification for the view of a specific organism of dysentery would therefore appear to be near at hand."

The admission rate from diarrhœa was slightly increased, but the death rate much greater. High rates were those of Barrackpore ; of Neemuch, Nasirabad, and Mhow, in the famine tract ; and of Ranikhet. The second group had copious rain after drought ; and during the outbreak at Mhow the water contained more vegetable débris and suspended matter than usual, and the disease ceased by September, when the water had cleared a good deal. The epidemic at Ranikhet was of "hill diarrhœa," and was attributed to chills from the great fall of temperature on the onset of the rains.

Hepatic Abscess.—Both the admission and the death rates from abscess of the liver rose. The Bengal Command and the Burma Coast Group had the highest mortalities. There were 5 deaths each at Rangoon, Barrackpore, Lucknow, Mhow, and Poona ; and the highest death ratios were those of Barrackpore, Ahmedabad, and Saugor. Two of the fatal cases at Barrackpore, one with a single abscess and one with multiple abscesses, occurred immediately after attacks of influenza. At Rangoon one man just recovered from abscess of the liver associated with dysentery contracted enteric fever and died. A case at Jutogh was diagnosed by the help of the serum test as Malta fever, but on post-mortem examination the disease was changed to abscess of the liver.

As due to abscess of the liver were returned 95 deaths, but to these may be added 15 returned under other heads (enteric fever, dysentery, heatstroke, ague), in which examination of the body after death showed the presence of abscess of the liver. In these 110 the post-mortem record is complete only for 86, of which 46 were associated with ulceration, and 40 not associated. Out of the 40, 4 had scars of former ulceration, 2 had dysenteric symptoms without ulceration, and in 34 there was no trace, and no history, of either ulceration or dysentery.

Excluding 38 cases in which postmortem examination was omitted or was incomplete, the total number of fatal cases in which abscess of the liver was found in the 5-year period 1896-1900 was 453. In 238, or 53 per cent., there was found ulceration of the intestine, and in 215, or 47 per cent., no ulceration ; in 161, or 36 per cent., there was a single abscess, and in 292, or 64 per cent., there were more than one.

Among the 238 associated with ulceration, there was a single abscess in 66, or 28 per cent., while there were multiple abscesses in 172, or 72 per cent. On the other hand, when the suppurative hepatitis was unassociated with ulceration, there were 95 cases, or 44 per cent. in which the abscess was single and 120, or 56 per cent., in which the abscesses were multiple.

Again out of the total of 161 single abscesses, 66, or 41 per cent., were associated with ulceration, and 95, or 59 per cent., not so associated. In contrast to this, among the 292 cases of multiple abscess 172, or 59 per cent. were associated, 120, or 41 per cent., unassociated with intestinal ulceration.

It appears that a considerable proportion of cases of abscess of the liver are not connected with ulceration in the intestinal canal ; that the ulceration leading to liver abscess may be of any kind ; and that when there is no ulceration, there is a greater chance of the abscess being single than when there is ulceration.

---

*Shiga in D. M. W. XXVII, page 785, has since given a similar opinion.

Another case of multiple abscess from appendicitis has been recorded, also a case due to ascarides. A dysenteric abscess of the liver has been described in a child of 6 years of age ; and years ago in India a case was reported in which the child was only 6 months old, the cause unknown. Washbourn has noted that abscess of the liver is a rare complication of dysentery in South Africa, and Macfarlane that he has never seen a case in a native at Lagos, though dysentery is prevalent. Mott and Durham suggest that abscess does not supervene when the environment is normal ; but that there is something wanting in this explanation seems to be suggested by the frequency with which dysentery and abscess of the liver are said to be associated in Bosnia and Roumania.

The mortality from abscess of the liver in 1900 was 31 times greater among European than among native soldiers, while in 1899 it had been 32 times greater, and 25 times greater in 1898. On the other hand, the admission ratio from dysentery in 1900 among European soldiers was to the ratio of the native soldiers as 1 : 1·95, the difference being greater than in the four years preceding.

Venereal diseases.—The admission rate from venereal disease for India was 298·1, against 313·4 in the previous year, and 362·9 in 1898. In other words, in 1900 for every 1,000 men there were about 15 fewer admissions to hospital for venereal disease than in 1899. From the reports of medical officers it appears that the decrease was believed to be principally due to the absence of drafts of young men, to measures taken under the Cantonment Act for the expulsion or treatment of diseased women, to measures taken to warn the men, to keep them out of mischief, or to improve their cleanliness, and to the frequency with which bazaars, villages, localities, and areas were placed out of bounds on account of the prevalence of venereal disease, plague, cholera, or small-pox ; and that the ratio would have been still lower had it not been for the increase of solicitous prostitution caused by the famine. Other causes of the decrease of admission are mentioned, such as the continuous treatment of patients, which prevented relapses ; the out-patient system ; the prevalence of ague, which weakened the men and rendered them less inclined to venery ; confinement to cholera camps ; various measures adopted to remove temptation or lessen risk, such as : public lectures and private warnings with the object of increasing moral tone and self-control, and explaining the risks run ; the encouragement of temperance in drink ; warning the men against specially dangerous places, as on the march up to the hills ; encouraging games and athletics by day, and providing amusements and comforts in the evenings ; the provision of places and means of ablution ; encouraging the men to point out the women from whom, or the places where, they contracted disease ; laying down a rule that venereal patients after discharge from hospital had to make up the guards, &c., which had fallen upon others owing to their being in hospital. Various causes of local increase are given. In several cases putting the bazaar out of bounds was not productive of much or any benefit ; and at Poona the measure was followed by a great increase of clandestine and roadside prostitution. In fact, both in the plains and in the hills clandestine prostitution down the khuds and on the roadside was both more dangerous and more difficult to deal with than bazaar prostitution ; and prostitutes, when driven from one place, simply went to another beyond the limits of the commanding officer's authority, and let the soldiers know through touts. Soldiers often refuse to point out the women from whom, or the place where, they contracted disease ; and, of course, if the disease has been contracted in a locality out of bounds, they are only refusing to incriminate themselves. The amount of success attained in inducing the women to submit to treatment was very different in different stations ; and no doubt, personal influence counts for more than the mere taking of pains.

In 1900 there were 1,630·33 (against 1,851·31) men constantly sick in hospital from venereal disease. The average stay of a case of venereal disease is hospital was 32·97 days (against 31·89) ; and the total loss of service was about 595,070 days (against 675,728). There were 14 deaths (0·23 per 1,000 of strength), and 380 invalidings (6·28 per 1,000) directly due to venereal disease, against 14 or 0·21 per 1,000 of strength, and 442, or 6·53 per 1,000.

The only ratios over 600 per 1,000 of strength were those of Neemuch and Deesa. The greatest increases of ratio (increases of more than 100 per 1,000) were at Subathu. Gharial, Lower Topa (strength 59), Meiktila, Pallaveram (strength 81), Deesa, Neemuch, Nasirabad, Indore, Mhow, Satara, Mount Abu (strength 95), and Purandhur. The medical officers of Deesa, Neemuch, Nasirabad, Indore, Mhow, and Mount Abu refer to the large amount of disease caused by the numbers of famine-stricken women who resorted to prostitution to earn money enough to buy food.

Only the Bengal and Madras Commands shared in the decrease, there being a large increase in Bombay (influence of the famine), and a small increase in the Punjab.

Invaliding.—In the whole army of India 2,026 men were invalided, or 33·46 per 1,000 of strength, against 2,142 and 31·64 in the preceding year, the increase being greatly due to the larger number of men invalided for rheumatism and for debility, and being shared in by all the commands except Bengal. The proportion of invalids to strength was lowest in the Punjab and, as usual, highest in Madras. The percentage of men who were invalided while under 25 years of age to the whole number invalided was 52, against 59 in 1899. Of the total number of men invalided, 33 per cent. (against 38) were of less than two years' service, and 72 per cent. (against 81) were of less than five years' service. Invaliding from venereal diseases takes place pretty evenly through year by year of service and mostly at the ages of from 20 to 30. Invaliding from hepatitis, from debility, and from rheumatism is more affected by advance of age than by length of service, though the last service-period is that which sees the highest proportion of invaliding from these causes. For palpitation and valvular disease the greatest proportion of invaliding usually falls in the period between 20 and 25, though sometimes in that over 40, and in the first three or four years of service.

Officers.—The chief causes of admission among officers were ague and simple continued fever; and while the admission rates from cholera, small-pox, ague, and influenza rose, those from pneumonia, other respiratory diseases, enteric fever, dysentery, and hepatitic affections fell. The chief causes of death were enteric fever and cholera, but the ratio of the former was lower than in the previous year. Among the increased ratios were those of cholera, small-pox, and circulatory diseases. The admission rates from ague, tubercle of the lungs, respiratory diseases, hepatic abscess, and venereal diseases were lower than among the men, as were those of all the causes of death tabulated, except cholera and small-pox. One officer suffered from a second attack of enteric fever. Three cases were contracted in one hotel; two were attributed to impure milk; and two officers were supposed to have become infected when out shooting. One of the two stayed in a native village without filter or soda-water, and drank from any source when he was hot and thirsty.

Women.—The health of the women was not so good as in 1899. The chief causes of admission were debility, ague, and the diseases peculiar to women. All the diseases tabulated had higher admission rates, except pneumonia and dysentery. Debility caused about 38 per cent. of the total admissions, and ague about 18 per cent. Here it may be noted that at Subathu 21 of the cases of "debility" were due to childbirth; that at Rangoon 15 women were wrongly entered as debility simply to enable them to be with their sick children; and that at Meerut one death from debility and one from ague occurred in women recently delivered. The chief causes of death among women were enteric fever, dysentery, and cholera. All the diseases tabulated gave increased mortality, except pneumonia, hepatic abscess, childbirth, ague, and simple continued fever. Enteric fever caused nearly 14 per cent. of the total deaths. No special remarks of value are made by the medical officers as to the causation of the enteric fever of women and children.

Children.—There was a falling off in the health of the children. The chief causes of admission were ague, respiratory diseases, and measles. All the diseases tabulated gave increased admission rates, except whooping cough, measles, influenza, and enteric fever. Ague caused 22 per cent. of the total sickness, respiratory diseases 12½ per cent., and measles nearly 9 per cent. The chief causes of death were diarrhœa, debility, and respiratory diseases. There were increased death rates from all the diseases tabulated except convulsions, respiratory diseases, teething, simple continued fever, and cholera. Diarrhœa caused nearly 17 per cent. of the total deaths, debility (including immaturity at birth) over 12 per cent., and respiratory diseases over 10 per cent. Cases of measles were most numerous at Calcutta, Subathu, Rawalpindi, and Ferozepore. Three cases of scarlet fever occurred at Quetta, and one at Rawalpindi. The seven cases of diphtheria were divided between Fort William (two), Dum-dum, Sialkot (two), Peshawar, and Bangalore. At Sialkot it is stated that insanitary conditions likely to cause the disease were sought for but not found. There were 17 admissions from tubercle, the intestines or peritonæum being affected in five. The age of the only child that died of tubercle of the intestines (and lungs) was 16 months. No remarks are given about these cases. The liability to death was greatest under six months, the height of the percentage being, as usual, to a considerable degree due to cases of immaturity at birth. The liability gradually decreased up to 15 years of age.

Native Troops.

Sickness and mortality in 1900.—The health of the Native troops, like that of all other classes of the population, was worse than in the preceding year, as shown in the following table. The year was one of famine and bowel complaints, of malaria, cholera, and small-pox.

Year.	Average strength *	Ratio per 1,000 of Strength. Admissions into hospital.	Constantly sick.	Deaths from Cholera.	Remittent Fever.	Pneumonia.	Dysentery.	All causes.	Mortality, including absent deaths.
1896–1900 ...	127,223	781	30	1·03	1·14	3·36	·51	11·81	15·69
1899	128,529	795	38	·53	1·17	3·86	·35	10·70	14·50
1900	123,463	785	30	3·16	1·34	3·32	·63	14·04	18·57
1891–1900 ...	127,666	852	32	1·11	1·25	3·24	·59	12·22	16·62

* The quinquennial ratios are, of course, worked on the total strength of the lustrum.

The chief causes of admission were ague, dysentery, and venereal disease. Though there were lessened admission ratios from influenza and respiratory diseases, there were raised ratios from cholera, enteric fever, ague, dysentery, diarrhœa, small-pox, venereal diseases, scurvy, and tubercle of the lungs. Ague caused 41 per cent. of the total admissions. The chief causes of death were pneumonia, cholera, and remittent fever. Among the diseases which caused increased mortality, were cholera, diarrhœa, debility, dysentery, enteric fever, small-pox, malarial fevers, and tubercle of the lungs. Pneumonia caused nearly 24 per cent. of the total deaths, and cholera over 22 per cent. The total number invalided for discharge was 1,378, and the chief causes of invaliding were debility, rheumatism, and venereal diseases.

The small Mishmi Field Force suffered chiefly from ague and dysentery, and the China Expeditionary Force from ague, dysentery, and respiratory diseases.

If the following Table be compared with that on page 42, it will be seen that the native soldier suffered less from enteric fever, simple continued fever, diarrhœa, hepatic affections, and venereal diseases; equally from small-pox; and more from each of the other causes of admission given, than his European comrade. He also suffered more from scurvy. These relations are usual, except with regard to influenza, small-pox, and tubercle.

Ratios of Commands.

—	Ratio per 1,000 of the Average Strength. Bengal Command.	Punjab Command.	Madras Command.	Bombay Command.	Hyderabad Contingent.	Army of India.*
I.—Average Annual Strength	26,589	42,311	20,407	24,908	6,260	123,463
II.—Constantly-Sick-rate of the Year... ...	30·5	27·7	29·7	34·9	22·2	30·0
III.—Admission-rate of the Year :						
Influenza	1·8	·1	1·2	1·1	1·6	·9
Cholera	1·7	7·8	4·6	5·2	6·5	5·2
Small-pox	·3	·5	1·2	·7	·8	·6
Enteric fever	1·3	·3	·1	·2	—	·4
Intermittent fever	294·6	340·3	248·9	397·3	189·9	320·8
Remittent fever	10·8	19·6	8·5	13·3	13·2	14·9

* Excluding China Expeditionary Force, and including troops in Extra India not in the Indian Command.

Ratios of Commands—continued.

	Ratio per 1,000 of the Average Strength.					
	Bengal Command.	Punjab Command.	Madras Command.	Bombay Command.	Hyderabad Contingent.	Army of India.*
III.—Admission-rate of the Year—*continued:*						
Simple continued fever	·5	·4	9·2	5·1	10·2	3·5
Tubercle of the lungs	5·5	4·8	2·0	2·6	·6	3·7
Pneumonia	11·1	20·0	8·9	16·5	8·3	14·6
Other respiratory diseases	21·4	25·1	23·2	28·8	8·6	24·0
Dysentery	42·5	54·2	28·2	67·4	49·3	50·4
Diarrhœa	8·1	10·2	2·1	26·8	3·8	11·4
Hepatic abscess	—	·1	·1	·1	—	·1
„ congestion and inflammation	1·1	·9	1·0	2·6	1·8	1·3
Scurvy	1·1	2·4	·4	7·9	9·6	3·2
Venereal diseases	38·8	22·8	48·9	69·7	60·7	42·5
All Causes	716·5	795·7	690·4	956·8	561·0	784·6
IV.—Death-rate of the Year:						
Cholera	1·32	4·28	3·09	3·49	3·83	3·16
Small-pox	—	—	·05	·04	·32	·03
Enteric fever	·45	·05	·05	·12	—	·15
Intermittent fever	·79	·43	1·03	·92	·64	·73
Remittent fever	1·13	1·30	1·18	2·13	·32	1·34
Simple continued fever	—	·02	·10	—	—	·02
Circulatory diseases	·15	·07	·39	·52	—	·24
Tubercle of the lungs	1·05	·97	·49	·56	·32	·78
Pneumonia	1·99	4·30	1·91	4·38	4·15	3·32
Other respiratory diseases	·34	·66	·29	1·00	·64	·58
Dysentery	·49	·45	·39	1·37	·16	·63
Diarrhœa	·26	·31	·05	·60	—	·29
Hepatic abscess	·04	·05	·05	·08	—	·05
Anæmia and debility	·26	·12	·29	·24	—	·22
All Causes	10·46	14·72	12·69	18·71	12·62	14·04

* Excluding China Expeditionary Force, and including troops in Extra India not in the Indian Command.

Commands.—Of the commands, Bombay was the most unhealthy, and it was also more unhealthy than in 1899. It had the highest mortalities from remittent fever, pneumonia, other respiratory diseases, dysentery, diarrhœa, and hepatic abscess. The highest mortality from enteric fever and from tubercle of the lungs was in Bengal, from cholera in the Punjab, and from small-pox in the Hyderabad Contingent.

Geographical Groups.—The most unhealthy group for the decennium was Assam; but for 1900, Bengal-Orissa. The change was not due so much to increase of disease in Bengal-Orissa as to improvement in Assam, an improvement of health shared in by the prisoners and by the general population. In 1900 Burma Inland had the lowest admission ratio from pneumonia, and the highest from other respiratory diseases; Bengal-Orissa the highest from ague and dysentery: Gangetic Plain the highest from influenza and enteric fever; Indus Valley the highest from cholera and pneumonia, and the lowest from venereal disease; Central India the highest from remittent fever, scurvy, and venereal disease; the Deccan the highest from small-pox; Western Coast the highest from

diarrhœa and hepatitis, and the lowest from ague; Southern India the highest from simple continued fever, and the lowest from dysentery and scurvy; the Hills the highest from tubercle of the lungs. In the decennium also pneumonia was most prevalent in Indus Valley and least so in Burma Inland, and remittent fever was least prevalent in Southern India.

Ratios of Geographical Groups.

	Ratio per 1,000 of the Average Strength.												
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	
	Burma Coast and Bay Islands.	Burma Inland.	Assam.	Bengal and Orissa.	Gangetic Plain and Chutia Nagpur.	Upper Sub-Himalaya.	North-Western Frontier, Indus Valley, and North-Western Rajputana.	South-Eastern Rajputana, Central India, and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	Army of India.*
I.—Average Annual Strength	1,406	4,123	1,498	2,565	5,658	15,326	15,861	11,169	17,670	2,435	6,764	19,885	123,463
II.—Constantly-sick-Rate of the Year.	30·8	33·6	38·1	44·8	31·0	25·8	32·0	37·5	28·2	31·6	33·0	34·3	30·0
III.—Admission-Rate of the Year:													
Influenza	—	—	—	·4	6·9	·2	—	1·3	1·4	2·1	1·0	·7	·9
Cholera	—	—	·7	2·3	2·5	·9	15·6	8·6	6·6	1·6	4·0	3·0	5·2
Small-pox	—	·5	—	1·1	·2	·4	·8	·7	1·9	·4	·1	·2	·6
Enteric fever	—	—	—	1·1	1·2	·5	·1	·1	·1	—	·3	·7	·4
Intermittent fever	186·3	618·5	250·3	651·1	230·3	309·1	384·3	464·7	250·0	156·5	186·4	310·1	320·8
Remittent fever	22·0	4·4	6·0	7·0	6·2	13·3	21·9	22·1	10·5	4·1	3·8	22·1	14·0
Simple continued fever	·7	·3	—	—	·4	·7	5	4·2	11·5	3·7	14·3	·7	3·5
Tubercle of the lungs	—	2·4	3·3	5·1	4·6	5·4	3·4	3·7	1·3	2·5	2·2	7·8	3·7
Pneumonia	2·8	2·2	6·0	5·1	10·6	13·3	24·6	15·5	9·6	18·9	13·9	21·7	14·6
Other respiratory diseases	20·6	40·3	39·4	25·0	34·3	14·0	33·0	17·5	16·8	31·2	17·9	32·1	24·0
Dysentery	60·5	43·4	97·5	102·1	42·6	35·8	52·5	57·6	40·6	90·8	19·7	60·3	50·4
Diarrhœa	·7	3·6	9·3	13·3	11·0	6·4	12·2	·1	6·8	52·6	2·7	14·7	11·4
Hepatic abscess	·7	—	—	—	—	—	·1	·1	·1	—	·1	·2	·1
„ congestion and inflammation.	—	·5	1·3	1·1	1·1	·7	·8	1·6	1·6	3·7	1·2	2·2	1·5
Scurvy	1·4	·2	·7	3·9	1·8	·9	3·6	7·3	4·4	1·6	·1	3·4	3·3
Venereal diseases	84·6	30·6	26·0	42·1	28·6	26·4	19·5	97·8	68·6	32·4	50·9	45·6	42·5
All Causes	785·2	1,037·6	714·3	1,157·1	716·3	676·0	927·9	1,017·3	717·0	701·8	651·8	836·2	784·6
IV.—Death-rate of the Year:													
Cholera	—	—	·67	2·34	1·77	·65	8·39	4·75	4·30	1·23	2·81	1·46	3·16
Small-pox	—	—	—	—	—	—	—	·09	·17	—	—	—	·03
Enteric fever	—	—	—	—	·53	·26	—	·09	·06	—	—	·10	·15
Intermittent fever	4·98	·49	1·34	3·51	·53	·52	·19	1·07	·40	2·05	1·33	·75	·73
Remittent fever	2·13	·97	—	2·34	·88	1·04	1·70	3·22	·68	·41	1·18	1·76	1·34
Simple continued fever	—	—	—	—	—	—	·06	—	—	—	·30	—	·02
Circulatory diseases	1·42	—	—	—	·18	·07	·13	·18	·40	·41	·44	·30	·24
Tubercle of the lungs	—	·49	·67	·39	—	1·17	·57	·81	·17	·82	·74	2·21	·78
Pneumonia	·71	24	—	—	1·59	2·35	6·43	5·10	3·11	5·34	3·25	3·82	3·32
Other respiratory diseases	—	·49	1·34	·78	·53	·52	·88	·45	·45	·82	·30	1·11	·58
Dysentery	·71	·73	—	1·17	·18	·33	·57	1·25	·40	2·87	·15	·70	·63
Diarrhœa	—	—	—	·78	·35	·33	·32	·45	·06	3·70	·15	·25	·29
Hepatic abscess	—	—	—	—	—	—	·06	·09	·06	—	—	·15	·05
Anæmia and debility	—	·24	1·34	—	—	·13	·06	·09	·17	·82	·30	·40	·22
All Causes	14·22	4·12	7·34	14·42	7·78	8·55	21·37	21·04	13·75	25·05	14·04	15·39	14·04

* Excluding China Expeditionary Force, and including troops in Extra India not in the Indian Command.

Stations.—The highest death-rates of the large stations throughout India with a strength of not less than 1,000 were those of Kohat, Bombay, Edwardesabad, Secunderabad, and Abbottabad. In all these cholera broke out, very severely at Kohat, and severely at Secunderabad. They also all had high ratios from pneumonia, especially Edwardesabad. Bombay had in addition high ratios from diarrhœa, dysentery, ague, and plague; Edwardesabad from remittent fever; Secunderabad from beriberi and remittent fever; and Abbottabad from tubercle of the lungs and remittent fever. Besides the detachments of the 2nd Punjab Infantry on the frontier, which suffered principally from ague, the most unhealthy regiments were the Mewar Bhil Corps at Kherwara, the 19th Punjab Infantry at Sialkot and Kohat, the 2nd Bombay Grenadiers at Bombay, the 5th Punjab Infantry at Edwardesabad and Miranshah, and the Malwa Bhil Corps at Sirdarpore. The first two had outbreaks of cholera and much malarial fever; and at Kherwara there were in addition badness and dearness of supplies, with the result that the nutrition of the men was below par, and bowel complaints were common. At

Sirdarpore also the water was scanty and bad and the grain mouldy and fermented, causing dysentery and diarrhœa and guinea worm; and, besides, there was more malaria, and detachment duties were more frequent. The 5th Punjab Infantry had less influenza, malarial fever, and dysentery than in the previous year; but there was an epidemic of pneumonia.

Principal diseases: Influenza.—Influenza greatly decreased, the admissions and deaths being fewer than in any year since the disease invaded India in 1890. July and March were the maximum months in 1900; but for the eleven years' period April and March, with the minimum in October and September. The highest number of cases was 39 at Doranda in the Gangetic Plain. The native troops were far less affected than either the European troops or the prisoners. That prisoners are fonder of going to hospital than free men and that their being cooped up renders them more liable to pulmonary complication may explain their comparatively high ratios. A comparison of 1891–1900 with 1880–1889 does not reveal the expected increase of pneumonia, perhaps because, in accordance with the Nomenclature, influenzal pneumonia is returned as influenza, and not as pneumonia.

Cholera.—There were 666 cases (641 admissions) of cholera with 390 deaths, against 126 with 68 in the preceding year; and the admission and death-rates were, of course, much increased, and also much above the decennial rates. Cholera reached its maximum in July; but it was present every month, especially May-September. By far the most important outbreak was that at Kohat in which the 19th and 6th Punjab Infantry, and the 3rd Punjab Cavalry, specially participated; and the next highest numbers were at Secunderabad and Kherwara. A special investigation into the Kohat outbreak was made by Major Firth, who agreed with the local medical officers that it was directly attributable to specific pollution of the irrigation water which runs freely through Kohat. Though he was unable to satisfy himself of the existence of Koch's spirillum in the irrigation water, the ready detection of spirillar and allied forms was considered sufficiently confirmative of the suspicion attaching to the stream. The 19th Punjab Infantry, which was the regiment most severely affected, arrived, free from cholera, in Kohat on the morning of the 6th July. Either from a misconception as to the propinquity of the pipe supply, or from ignorance of the danger from the irrigation water, the men, under the stress of marching in on a July morning, consumed large quantities of the irrigation water. During the next 48 hours 26 cases of cholera occurred among the sepoys and followers, and on the next day 61 more. Removal of the corps to a camp away from all irrigation and to a water above suspicion rapidly checked the outbreak. It is not known how the irrigation water became infected, but the disease was at the time spreading epidemically in the Punjab, and the first reported death in Kohat city occurred on the 5th July. The men of the 6th Punjab Infantry and other regiments are also supposed to have drunk the polluted irrigation water, because it was so much cooler than the pipe water. At Secunderabad the disease had become epidemic in the city and neighbourhood before it appeared in the regiments. The 24th and 11th Madras Infantry suffered most. With regard to the Kherwara cholera in the Mewar Bhil Corps, it is stated that it was probably caused by a polluted water-supply, and ceased when some wells sunk in the old river bed were closed.

Small-pox.—There were 78 cases of small-pox with 4 deaths, against 46 with 2 in the preceding year, and the admission ratio was above the decennial. The cases were mostly mild, in vaccinated men. Thus, Secunderabad with 21 cases had only 1 death. No other station had more than 4 cases. The 11th Madras Infantry had 10 cases, and no other regiment more than 4. The infection was derived from the general population, in which there was a recrudescence of the disease.

Ague, remittent fever, simple continued fever.—To ague was due nearly 41 per cent. of the sickness of the native army. The year being wetter than its predecesor, an increase of ague was to be expected, and the increase was, of course, not confined to the native troops. The most malarious group was Bengal-Orissa, but it was less malarious than in 1899. The greatest increase was in Group VIII., which comprises many of the districts where plentiful rain succeeded famine-drought, and the next greatest in Group VI., wherein is included much of that part of the Punjab in which conditions were somewhat similar. The most malarious month was October, and the least malarious March. The highest number of cases was in the 5th Bombay Infantry, its first year at Aden; the 28th Punjab Infantry at Wana; the 12th Bengal Infantry at Alipore, but

fewer than in the previous year; the 8th Bombay Infantry at Delhi, newly arrived from Ahmednagar at a time when malaria was rife at Delhi; the 1st Bengal Infantry in Mauritius; and the 13th Bombay Infantry at Deesa in Group VIII. The medical officer of the 1st Bengal Infantry mentions there were fewer cases in the regiment owing to its being stationed on a healthy plateau in the interior of the island, where he was only able to find one specimen of *anopheles* in the course of the year; and that most of the admissions took place early in the year, while the men were still feeling the influence of the malarious climate of Port Louis, where *anopheles* is plentiful.

Remittent fever caused 9½ per cent. of the total deaths; and prevailed most in October and least in February, though it was pretty evenly distributed throughout the months of the year. The death-rate was high, the admission rate rather low. It was most prevalent in Groups VIII, XII, I, and VII. The greatest numbers of cases were at Kohat, Rawalpindi, Kila Drosh, Edwardesabad, Peshawar, Maymyo, and Agra; and hill stations garrisoned by Gurkhas had high numbers, which is suggestive in view of the fact that Gurkhas suffer much from tuberculosis as well as comparatively much from enteric fever. The 10th Madras Infantry at Maymyo, and the 4th Bengal Infantry at Agra (from Calcutta) had the highest numbers; and next came regiments at Kohat, Almora, Sirdarpore, Abbottabad and Kohat, and Peshawar.

That the reports of medical officers are not uniformly favourable is, in the light of present knowledge, a call to more method and perseverance in the prophylactic use of quinine in sufficient doses.

The 4th Infantry, Hyderabad Contingent, at Ellichpur, and the 26th Madras Infantry at Vizianagram, had the most cases of simple continued fever: and in the latter they are said to have been due to exposure to the sun at musketry and to fatigue duties in building the new barracks. In the 16th Madras Infantry at Singapore the cases were afterwards thought to have really been influenza. Exposure and chill were the causes assigned in the 3rd Madras Lancers at Secunderabad.

Enteric fever.—There was a great increase both in the admission and in the death rate from enteric fever. The ratios for European troops are very unlike those for native troops and prisoners; and, as the total death ratio for fevers (ague, remittent, simple continued, enteric) among European troops was to that among native troops as 2·5 : 1, the difference cannot have been altogether due to want of recognition of the disease among the latter. As usual, the ratios of the Gurkha regiments taken together were higher than those of the native troops as a whole.

The results obtained by Major Freyer in the testing of the blood reaction of natives were criticized in the report for 1896, page 71, and have been finally disposed of as erroneous in a recent paper by Captain Lamb. In the same paper by the narration of 11 cases it is shown that enteric fever among natives of India is commoner than is sometimes supposed, and that the serum test is a trustworthy means of recognizing it, the diagnosis in two of the cases being supported by the results of *post-mortem* examination. Major Burke has lately stated that the disease, though rare in ordinary natives of India, has been seen by him many times among Parsis and among members of the native aristocracy, the former having no caste, and the latter being often above caste prejudices. But it is noteworthy that, though 4 of the patients reported on by Lamb were native Christians and 1 a Goanese, 3 were Brahmins and 3 Hindus, and therefore not likely to be Europeanized in food or other habits. According to what has been already said, it seems possible that the increase in cases returned among natives may not be altogether due to the improved methods of diagnosis now available, but in part also to a greater prevalence and intensity of the infective material. If this be so, the increase should continue. Evidence as to the frequent occurrence of the disease among the Chinese goes on accumulating, one of the most interesting recent contributions being that of Clark, which offers anatomical as well as clinical proof.

In the whole native army of India 54 cases with 18 deaths were returned, as against 18 with 3 in 1899. Abbottabad, Benares, and Dehra Dun had the highest numbers of cases. To the total 16 regiments contributed, but the 42nd Gurkhas no less than 29 admissions, mostly at Benares and on the march. Neither in the case of this regiment nor in that of any other do the annual reports throw any light on the origin and causation of the disease. In some cases the serum reaction test was used in diagnosis. In only two of the fatal cases was a *post-mortem* examination obtained, but in both the result was quite confirmatory of the clinical diagnosis.

There were returned 7 cases of Malta fever, 2 from the 23rd Pioneers at Meean Meer, 2 from the 29th Punjab Infantry at Peshawar, 1 from the 7th Bengal Mountain Battery at Datta Khel, and 2 from the Malakand Force. The diagnosis in the cases of the last

two corps was clinched by the sedimentation test with the *Micrococcus Melitensis*. In addition, Lieutenant Greig of the Malakand Force tested the blood of 15 men who had been in hospital with prolonged "remittent fever," and with that of one, several months after his discharge from hospital, obtained a positive reaction.

Plague.—In 1900 there were 56 cases (55 admissions) of plague with 29 deaths, against 76 with 45 in 1899, and 94 with 58 in 1898. The comparative immunity of the sepoys as compared with the populations surrounding them is ascribed to the large number of men inoculated, many of them twice, and to the immediate segregation of patients and evacuation of buildings whenever cases did occur. The 15th and 21st Madras Infantry at Belgam, where plague was raging, had between them 31 cases and 13 deaths, and the case which occurred at Vizianagram was imported from Belgam. Four corps at Bagalore had only 12 admissions and 4 deaths among them. All the five cases in the 27th Madras Infantry in Mauritius were fatal; but the disease was checked by removal to the uplands. Four cases at Bombay, one at Poona, one at Alipore (imported from Fulta), and one on the march at Ratlam, make up the total.

It has been suggested that the failure of limejuice in certain cases may be due to an obscure gradual decomposition, and that the limejuice used should always be as fresh as is obtainable.

Tubercle of the lungs.—There was a rise in the admission and death rates from tubercle of the lungs, the rise of the former being greatest in Bengal and of the latter in Madras. The Bengal Command had the highest admission and death rates, and the highest group admission ratio was that of the Hills; these relations being connected with the fact that the Gurkhas suffer more than other native soldiers from pulmonary tuberculosis. The five highest numbers of cases were in Gurkha regiments. The highest number of cases was in the 1–2nd Gurkha Rifles at Dehra Dun, but no reason is given. The medical officer of the 1–4th Gurkha Rifles at Bakloh blames insanitary barracks and the overcrowding of the married quarters, and the medical officer of the 43rd Gurkha Rifles at Shillong says that the remarkable and sudden increase is attributable to the overcrowding associated with small cubic and superficial space per man in the barracks. In the 1–1st Gurkha Rifles at Dharmsala the liability of his men is connected by the medical officer with their "fatal habit" of alternating woollen and cotton clothing regardless of the time of day or of the season of the year. Nothing is said as to any racial liability of Gurkhas; and if their higher ratios are simply due to bad sanitation, it is high time that something was done to prevent waste of life among these valuable soldiers. The space per man should be made ample, and never encroached upon; and European methods should be adopted to secure ventilation at times when the doors and windows are closed on account of cold.

As non-tubercular phthisis were returned 25 cases with 6 deaths. Because it is not likely that all these cases were really non-tubercular, it is to be hoped that fewer will be so returned in future.

Pneumonia and other respiratory diseases.—Coincident with, and perhaps partly dependent on, the decrease of influenza, there was a fall in the admission and death rates from pneumonia. In 1900 pneumonia caused 24 per cent. of the total mortality, and was, as usual, the chief cause of death. Admission was, as usual, highest in Groups VII and XII, and mortality in Group VII; but Western Coast and Central India had both higher mortality than the Hills. Both in Group VII and in Group XII pneumonia was most prevalent in the cold months, especially in January; and the same was the case for India as a whole. Among the stations with the highest ratios were Sibi, Miranshah, Edwardesabad, Mir Ali Khel, Kohat, and Naini Tal. The regiments which had most cases were the 5th Punjab Infantry at Edwardesabad and Miranshah, the 11th Bengal Infantry at Miranshah, the 6th Punjab Infantry at Kohat, the 2nd Sikh Infantry at Datta Khel, the 8th Bengal Infantry at Lucknow and Naini Tal, and the 4th Punjab Infantry at Kohat. In the 5th Punjab Infantry the disease was epidemic for about two weeks, and then suddenly subsided, though there were a few dropping cases afterwards. Malarial debility from former residence at Wana was considered to have rendered the men unduly susceptible. In the 11th Bengal Infantry the disease is described as having been epidemic malignant, septicæmic, and infectious; and the sick-attendants were not allowed to stay in the hospital longer than 48 hours. In the 2nd Sikhs the disease was ascribed to cold winds and chill; and in the 8th Bengal Infantry to malaria, chill, and dust, and not in any case to infection. The 3rd Punjab Cavalry at Kohat had only 8 cases, and the medical officer says that the disease was "non-infectious

this year," and due to malaria with chill. He adds that pneumonia patients must always have plenty of ventilation and cubic space, and that the sick attendants must be frequently relieved and never allowed to sleep in the ward. The carrying out of these rules may have been the reason why his cases were non-infectious and therefore few. At any rate, and especially if preceded by early diagnosis, they are sound preventives of spread.

Evidence as to the infectiousness of pneumonia is not confined to India, and there seems some reason to believe that when the disease is about, the nasal secretion as well as the sputum may be infectious. Pneumonia is, of course, only one of the pathological results which may be achieved by the pneumococcus. The period of incubation appears to be very short.

Other respiratory diseases were most prevalent in the Bombay Command, in the Burma Inland and Assam groups, in the stations of Mir Ali Khel, Wana, and Fort Sandeman, and in the 23rd Bombay Infantry at Mir Ali Khel and Fort Sandeman, the 6th Punjab Infantry at Kohat, and the 8th Bengal Infantry at Lucknow and Naini Tal. The causation is referred to chills, especially at the beginning of the cold weather and in malarious subjects.

Dysentery and Diarrhœa.—The admission and death rates from dysentery in 1900 were high. The greatest increase and the highest ratio were in Group IV. Of the 25 stations of over 100 strength which had ratios over 100 per 1,000, 11 were on the north-west frontier, five in the famine districts of Group VIII, three in Bengal, two in Ceylon, and one each in Groups III, X, V, and VI. Among those stations the highest admission ratios were those of Jandola, Kajuri Kach, Sarwekai, Tank (with Jatta and Draband), and Dibrugarh; and the highest death ratios those of Kherwara and Kajuri Kach. The 27th Punjab Infantry, and the 12th, 23rd, and 7th Bombay Infantry, all on the north-west frontier, the 13th Bombay Infantry at Deesa, and the 9th Madras Infantry at Colombo, had the highest numbers of cases. In the 12th Bombay Infantry the causes assigned are cheap fruit and polluted river water full of silt; in the 7th Bombay Infantry the cold of the climate after Jubbulpore; and in the 9th Madras Infantry change of diet and climate. Dysentery prevailed more in the second half of the year than in the first, the maximum month being October.

The diarrhœa ratios were considerably increased, and the greatest prevalence was in Western Coast. The 2nd Bombay Infantry, as in the previous year, had by far the largest number of cases, which the medical officer attributes to insufficient warm clothing in the wet cold months. The next largest number was in the Mewar Bhil Corps at Kherwara in the famine area, and the causes assigned are the poor quality of the food and the deficient water supply.

Venereal Diseases.—While among European troops an average strength of 60,553 gave 18,049 admissions, in the case of native troops an average strength of 123,463 gave only 5,242 admissions. In other words, there were only 42 admissions for every 1,000 men among native troops, against 298 for every 1,000 among British troops.

The admission rate was 8·4 per 1,000 of strength more than in 1899. There were nine deaths and 129 invalidings, directly due to venereal disease. The Bombay Command and the Hyderabad Contingent had the highest ratios and the greatest increases, and only Madras had a lower ratio. In all the commands the ratios of native troops were much lower than those of European troops. In 25 stations (against 20) the admission rate from secondary syphilis was over 20 per 1,000 of strength, and in 46 it was over 10 per 1,000. In India the ratio of primary syphilis *plus* soft chancre rose by 4·3 per mille of strength, that of secondary syphilis by 0·5, and that of gonorrhœa by 3·6. The Bombay Command and the Hyderabad Contingent had the highest ratios for primary syphilis *plus* soft chancre and for gonorrhœa, and the Bombay Command and the stations outside the Indian Command the highest for secondary syphilis.

As usual, the Gurkhas suffered much. The high ratios of the Gurkhas and of the troops stationed in Ceylon illustrate the well-known fact, referred to in the reports for 1895 and 1896, that men in a strange land, and perhaps separated from their families, are more prone to contract venereal disease. The Gurkhas also take no trouble to save themselves by cleanliness. Various minor reasons are given for the prevalence of venereal disease in different stations. But by far the most important increase of disease was in certain stations and regiments of the Bombay Command and the Hyderabad Contingent; and in the case of at least a dozen regiments, stationed at Erinpura, Deesa, Ahmedabad, Sirdarpore, Ajmere, Mhow, Sehore, Aurangabad, and Hingoli, the medical officers

attribute this to the extension of prostitution caused by the famine. This cause of increase, as has been already mentioned, was also potent in the case of European soldiers.

Beri-beri.—All the 146 cases of beri-beri (against 202) occurred in Madras regiments, 95 in the peninsular part of the command, 42 in Burma, and nine in the Bengal Command. The regiments which had most cases were the 11th Madras Infantry at Secunderabad, the 8th Madras Infantry at Rangoon and Port Blair, the 9th Madras Infantry at Bellary, Colombo, and Trincomalee, and the 26th Madras Infantry at Vizianagram. In the first it attacked natives of the East coast, who are considered to be very subject to the disease, and was most prevalent when the men were exposed to cold and wet in cholera camp. In the second the disease was almost entirely confined to the Hindu sepoys, at least in the case of the detachment at Fort Blair. The rest of the free population and also the prisoners were quite free from the disease, and no explanation could be found in dietary, &c. In the third there was improvement after resort to the issue of 4 oz. of meat daily. The medical officer of the fourth considered locally grown rice to have something to do with the causation, and issued bread instead.

Other evidence besides the above has been brought forward as to difference in racial liability. Fresh circumstances have also been recorded which tend to emphasize the part which articles of food are supposed to take in the spread of the disease. A new hypothesis is that *Blatta orientalis* serves as an intermediary between the man already infected and the man to be infected. Captain Rost believes that he has discovered the microbe agent of the disease in an angular bacillus found on rice; and the claim of a new coccus has been put forward by another observer. Some attention has been drawn to the possibility that cases of chronic arsenical poisoning might be wrongly diagnosed as beri-beri.

Jails of India.

Sickness and Mortality in 1900.—The year 1900 was hot and rather dry, with an approximately normal rainfall. But actual famine here, and the effects of famine there, were still present; and cholera, small-pox, and some other epidemic diseases were active; so that the health of the prisoners, like that of the general population was bad. Many of the prisons also were overcrowded.

The chief causes of admission to hospital were ague, dysentery, abscess, and diarrhœa. Among the diseases with raised admission rates were cholera, small-pox, influenza, dysentery, ague, and tubercle of the lungs. Ague caused 37 per cent. of the total sickness, and bowel complaints 18 per cent. The chief causes of death were dysentery, pneumonia, and tubercle of the lungs. Among the diseases with increased mortality were cholera, small-pox, gangrene, malarial fevers, pneumonia, and bowel complaints. Dysentery and diarrhœa caused 28 per cent. of the total deaths, pneumonia 13 per cent., and tubercle of the lungs 12 per cent.

A somewhat serious feature of the year was the increase and spread of cerebrospinal fever.

Administrations.—The prisoners of Assam, the Andamans, and the North-Western Provinces alone had better health than in the previous year; and the difference was considerable only in the case of Assam. The three most unhealthy administrations were, in order, the Andamans, Berar and the Central Provinces; and the three most healthy, in order, Madras, Burma, and the North-Western Provinces and Oudh. Of the former group, the Andaman and Berar had ratios higher than those of the quinquennium. As compared both with the previous year and with the quinquennium, the year 1900 had increase of mortality in the Andamans from remittent fever, pneumonia, diarrhœa, and debility; in Berar from cholera, respiratory diseases, bowel complaints, and tubercle; and in the Central Provinces from cholera, small-pox, remittent fever, tubercle and debility. Of all the administrations, the Andamans had the highest death rates from remittent fever and tubercle of the lungs; Berar from pneumonia, other respiratory diseases, dysentery, and diarrhœa; and the Central Provinces from cholera, small-pox, and debility.

Prisoners.

Administrations.	Years.	Average Strength.*	Ratio per 1,000 of Strength.†										
			Admissions.	Constantly Sick.	Deaths from								
					Cholera.	Remittent Fever.	Tubercle of the Lungs.	Pneumonia.	Other Respiratory Diseases.	Dysentery.	Diarrhœa.	Anæmia and Debility.	All Causes.
Andamans	1896–1900	10,975	1,689	51	...	3·17	5·50	2·48	1·02	10·04	2·26	2·00	32·31
	1899	11,293	1,937	57	...	3·19	7·62	2·57	1·33	15·58	2·75	2·92	42·24
	1900	11,580	2,039	54	...	4·92	5·70	4·75	1·04	9·67	4·23	3·54	40·41
Burma	1896–1900	13,127	626	30	2·00	·44	3·84	2·04	·43	4·27	·90	·46	20·54
	1899	12,548	584	26	1·99	·08	3·27	1·83	·08	4·62	·40	·56	18·73
	1900	12,516	556	28	1·76	·40	4·87	1·60	·24	3·91	·80	·56	21·17
Assam	1896–1900	1,284	961	49	4·67	2·65	1·40	2·65	1·71	8·88	4·05	3·58	44·24
	1899	1,323	962	48	13·61	4·54	1·51	3·02	3·02	6·05	4·54	1·51	55·18
	1900	1,314	769	37	·76	1·52	2·28	3·04	·76	6·85	·76	1·52	25·88
Bengal	1896–1900	18,121	1,067	37	2·40	·96	3·77	3·60	·91	7·76	1·57	·96	30·11
	1899	18,118	1,004	35	·28	·66	4·42	2·98	·99	6·18	·99	·77	23·79
	1900	19,593	1,156	40	4·44	·82	5·05	4·29	1·22	9·44	2·50	1·22	39·61
North-Western Provinces and Oudh.	1896–1900	32,128	883	45	·47	·47	2·71	4·86	1·00	6·09	2·04	2·66	27·86
	1899	29,303	792	38	·10	·41	2·90	4·44	·96	5·36	1·43	·65	22·25
	1900	31,083	764	36	·32	·32	2·73	3·64	·55	4·47	1·29	·93	22·10
Punjab	1896–1900	13,259	1,250	34	·20	·66	2·64	4·81	·77	3·15	1·04	·33	19·79
	1899	13,512	1,097	33	...	·44	2·96	4·81	1·18	2·52	·96	·15	18·72
	1900	15,550	1,230	37	·84	·26	3·73	5·21	·64	4·50	·84	·45	23·73
Bombay	1896–1900	8,759	773	29	3·27	2·44	2·74	6·12	1·35	3·27	3·04	1·46	33·72
	1899	8,981	614	28	·89	1·22	2·67	3·79	1·67	2·45	1·78	·89	24·72
	1900	11,495	784	28	5·92	3·31	3·65	6·70	1·30	5·22	4·52	2·87	46·80
Berar and Secunderabad.	1896–1900	1,659	637	19	1·93	·36	1·57	5·30	4·10	6·75	2·89	3·25	36·05
	1899	1,426	445	13	...	·70	1·40	1·40	·70	1·40	·70	2·10	13·32
	1900	1,927	943	26	6·75	...	2·59	11·42	6·23	20·76	9·86	2·08	79·92
Central Provinces ...	1896–1900	5,583	1,072	45	3·51	1·22	4·12	5·30	1·40	30·49	9·78	5·02	74·23
	1899	4,148	850	28	·24	·48	2·17	2·89	·48	4·10	1·69	1·69	24·59
	1900	5,728	926	30	7·68	1·40	4·36	4·02	1·05	19·90	9·43	5·76	68·44
Madras	1896–1900	8,870	646	27	5·30	·14	3·56	2·37	·54	4·10	·05	·34	28·30
	1899	8,806	502	22	·23	...	2·50	1·14	·68	1·59	...	·68	16·13
	1900	10,135	521	22	1·97	·30	3·65	2·27	·20	3·85	·20	·59	24·67
India‡	1896–1900	114,293	981	38	1·68	1·03	3·35	4·02	·94	7·04	2·10	1·67	29·97
	1899	110,016	918	35	·56	·82	3·55	3·34	·96	5·47	1·31	·95	23·87
	1900	121,811	977	35	2·28	1·21	3·95	4·22	·86	6·79	2·45	1·58	32·80
	1891–1900	108,606	1,024	39	1·99	1·20	2·98	4·27	1·09	6·81	2·18	1·78	30·29

* The quinquennial ratios are, of course, worked on the total strength of the lustrum.
† Excluding subsidiary jails.
‡ Including Ajmere, Quetta, and Mercara.

Andamans.—The rainfall was somewhat below that of the previous year, and much below the lustral average. Sickness and mortality showed a slight improvement. Increase of malarial fevers began with the advent of the south-west winds and rain in May; but

many of the cases treated were relapses in old cases from exposure. Quinine and cinchonidine were issued as prophylactics during the rainy season. An epidemic of influenza began in April, and another in November. The presence of a certain amount of scurvy, beyond what was returned, is attributed to the absence of good fresh vegetables and the rather monotonous diet of the prisoners. The list of vegetables given by the Senior Medical Officer is certainly not satisfactory, and it is to be hoped that the measures mentioned in the report for 1898 are being continued and pushed. Boiled water is provided at all the stations where many labouring convicts reside; but it is stated that cases of acute diarrhœa, often fatal, are caused by prisoners quenching their thirst at wayside sources. Efforts should be made to ensure that labouring prisoners always have ready access to the boiled water. After the invalid gang, the new arrivals had, as usual, the highest proportional mortality. The settlement has generally been distinguished by high death rates from remittent fever, tubercle of the lungs, and dysentery. Now, if the death rates of the ten years period before the report of Mr. C. J. Lyall and Dr. Lethbridge, 1882-1890, be compared with those of the ten years 1892-1900, the result is—

——	Remittent Fever.	Tubercle of the Lungs.	Dysentery.	All Causes.
1882-1890	2·97	4·28	4·16	27·33
1892-1900	4·11	4·29	10·08	33·89

The worst years in the second period were 1892, after the cyclone of November 1891, and 1899, a year of drought. Taking the above given rates of the first period as the standards, then remittent fever and all causes had high mortality in all the years of the second period, except 1896, 1897, and 1898; tubercle of the lungs in the years 1897, 1898, 1899, and 1900; dysentery in all the years. Separate accommodation has been provided for tuberculous patients, and reforms have been carried out in the water and vegetable supplies, &c., but the above statistics show how much remains to be done.

Burma.—The prisoners in Burma were fairly healthy. The Prome jail was overcrowded throughout the year, but was not unhealthy, perhaps because the population was kept in movement by monthly transfers. The overcrowding in eleven other jails was transient. The well water of some of the jails contained from 70 to 100 grains per gallon of total solids, but no ill effects were observed. The system of conservancy by trenching in the jail gardens is not found to be a cause of ill health in the jail population. The increase of tubercle was chiefly in the Central jails of Insein and Mandalay; and it is noted that the cases were segregated "as much as possible," and that care was taken to detect them at an early stage. The chief outbreak of cholera was at Bassein. Its origin was not traced, but food and flies were suspected to have been carriers of the infection. The medical officer of the Moulmein jail says that nothing short of removal of the jail to a higher and dryer site will effect permanent impovement, especially with regard to tubercle and dysentery.

Assam.—The health of the prisoners of Assam was most unusually good, and the population of the province was "fairly healthy." The chief feature was the great reduction in cholera, diarrhœa, and non-pneumonic respiratory diseases. There was also less malarial fever, and prophylactics were administered with apparently good effect. Improved accommodation is believed to have lowered the mortality in the Sylhet jail. The Tezpur jail, which recorded increased sickness and mortality, was situated amid a population extensively affected by bowel disease. As to the effect of the partial stoppage of extramural labour during the year by order of the Chief Commissioner, the Inspector-General considers it too early to judge.

Bengal.—The health of the Bengal population was bad, and so was that of the prisoners. Some jails were overcrowded as the result of disturbances and scarcity among the people. The statement that "even when there is no actual overcrowding, if the numbers are kept up continuously to the limit of the capacity, there is a marked increase in the number of cases of pneumonia and phthisis," seems to indicate that the officially sanctioned allowance of floor and cubic space is not sufficient. Excluding subsidiary

jails, there were 169 cases of cholera, of which 87 ended fatally, distributed over 21 jails; the most severe outbreaks being those of Palamau, Alipore, Chapra, and Champarun. At Alipore the disease appeared suddenly in the jail, and coincidently in various parts of Calcutta, after a heavy shower of rain. Prisoners from a cholera district were supposed to have brought the infection into the Palamau jail; and, indeed, it is stated that in nearly all cases the introduction of cholera was traced to newly admitted prisoners, to prisoners attending court, or to contaminated water outside the jail. Cerebrospinal fever and plague also occurred, as will be noticed below; and there was an increase of mortality from remittent fever (though malarial fever was less frequent), tubercle of the lungs (attributed to the increased crowding in jails), pneumonia, other respiratory diseases, dysentery, diarrhœa, and debility. There is reason to believe that some of the attacks of bowel disease were dependent upon the presence of intestinal parasites; and pneumonia appeared in the Ranchi jail in an epidemic form at the time when it was overcrowded with prisoners, owing to disturbances among the people. The Inspector-General notes that the seven Pasteur-Chamberland filters installed in Bengal jails have not proved very successful, while they are very costly and liable to get out of order.

North-Western Provinces and Oudh.—The North-Western Provinces and Oudh were "healthy, though not free from epidemic disease," and the health of the prisoners was fairly good, cholera, small-pox, and debility being the only diseases in the table with increased mortality. In the districts of Jhansi, Orai, and Lalitpur many of the men admitted into jail were suffering from the effects of famine. Every endeavour was made by transfers to prevent overcrowding of particular jails. The Inspector-General favours the reduction of the height of inner dividing walls, and an increase of the vegetable ration. There were no great outbreaks of cholera, but cerebrospinal fever appeared in three jails. The substitution of a new jail for the old one has been successful in reducing the once notorious mortality at Gorakhpur. The use of quinine prophylactically is only mentioned with regard to one jail.

Punjab.—The standard of health of the prisoners admitted to the Punjab jails in 1900 was low, on account of the prevalence in the province of famine, fevers, and bowel affections. The jails had increased mortality from cholera, small-pox, tubercle of the lungs, pneumonia, dysentery, and debility. There was a high mortality from sunstroke, owing to the late appearance of the monsoon rains. A great increase in the jail population made it necessary to accommodate large numbers of prisoners in tents in different jails; and tubercle of the lungs increased. The Inspector-General is taking measures to secure the construction of a special tubercle ward for the segregation of phthisical patients. The prisoners did not suffer so much as the general population from malaria, owing to their being placed in better sanitary conditions, and being defended by prophylactic doses of quinine. Cholera prevailed to a serious extent only at Mung Rasul. The outbreak was attributed to the drinking of water from an infected village well by prisoners working on canal excavation. At Ludhiana a virulent form of dysentery disappeared after the prisoners had been supplied for some time with fresh potatoes and onions. The Inspector-General believes that under the circumstances of the year mortality from pneumonia would have been higher had it not been for the attention paid to ventilation and cleanliness.

Bombay.—Famine and disease were prevalent in the Bombay Presidency, and the health of the prisoners was bad. The jail population was much increased, and all the jails, except three, were overcrowded throughout the year, so that relief could not be afforded by transfer. There was increased mortality from cholera, small-pox, remittent fever, tubercle of the lungs, pneumonia, dysentery, diarrhœa, and debility; and cholera, relapsing fever, and plague occurred in certain jails. The most serious outbreaks of cholera were at Thana and Dhulia. In both cases cholera was prevalent outside the jail. In the former the origin of the disease in the jail was not traced, and 19 buildings out of 21 furnished cases. In the latter the first case occurred in a man who drank water from a contaminated *nala* that flowed through the jail garden. It is not stated how such a *nala* was allowed to run open within the jail enclosure. Malaria was also prevalent, and cinchona alkaloids were issued prophylactically where necessary. Other measures adopted to improve the health of the prisoners were the issue of wheat instead of inferior cereals, the issue of potatoes instead of inferior vegetables, the issue of extra diet, special diet, extra clothing to weakly prisoners. The insanitary moat which surrounded the Thana prison has at length been filled up.

Berar.—Berar also was afflicted with famine and disease, and the prisoners admitted to jail were below par. The prison population was greatly augmented, and mortality from cholera and bowel complaints, from tubercle of the lungs, pneumonia, and other respiratory affections was much increased. But the heavy mortality was confined to Amraoti, Akola, and Basim. At Amraoti there was an epidemic of severe influenza, frequently ending in fatal pneumonia, an outbreak of cholera, and, during the rains, a food grain which was believed to be deficient in nutritive value. This last was brought to notice by the medical officer, and the necessary change was at once made. The difference between the high mortality in these three jails and the low mortality at Ellichpur, Buldana, Yeotmahl, and Secunderabad is not fully explained.

Central Provinces.—Famine and disease were rife in the Central Provinces, and though special executive orders prevented the swamping of the accommodation by hordes of physically deteriorated prisoners, yet all the jails, except two, were overcrowded at some time. Relief was obtained by utilizing worksheds inside the jails as sleeping barracks, and by extramural camps, the latter being, on the whole, a great success. It is noted that the physical condition of men admitted to jail was on the whole better than in the famine of 1897. There was increased mortality under all the heads given in the table; and cerebrospinal fever also occurred, especially at Raipur. In eleven jails there were 64 cases of cholera and 44 deaths, the highest numbers being at Nagpur, Nimar, Sambalpur, and Seoni. It is stated that the disease at Seoni was traced to impure milk, the boiling having been neglected. For the difficulty mentioned by the Inspector-General as to different systems causing variations in the number constantly sick a solution was provided in paragraphs 7 and 8 of Chapter VII. of the report of the jail commission of 1889, and sanctioned by the resolutions of the Government of India founded thereon.

Madras.—Scarcity and disease in the Madras province increased the number of prisoners, and made their physical condition bad. The general death-rate, though higher than in the previous year, was less than the lustral ratio. The increase was greatest in the district jails, and least in the central prisons. There was increased mortality from all the diseases shown in the table, except non-pneumonic respiratory diseases and debility; but only the ratios for remittent fever, tubercle of the lungs, diarrhœa, and debility were above their quinquennial ratios. Privation had affected many of the men admitted into the Cannanore and Vizagapatam jails; there was dysentery at Russellkonda, thought to have been caused by the effect of drought upon the water-supply; and Nellore and Russellkonda were the jails which suffered most from cholera. It was not discovered how the disease, which was prevailing in the town, got into the jail, especially as the persons and clothes of all newcomers were washed and disinfected; though it was thought that perhaps the warders might have been instrumental. The first man attacked had been 13 days in jail, and came from a locality where there was no cholera. Into the Russellkonda jail it is said to have been imported from a cholera area. Quinine was issued prophylactically with fair regularity in five jails, the reports from three being favourable. The Parvatipur jail was closed, as it was found the hillmen could be kept in good health at Vizagapatam.

Coorg. Rajputana. Baluchistan.—The Mercara jail was more healthy than in the previous year, the Ajmer jail much more unhealthy, and the Quetta jail slightly more unhealthy. The Ajmer jail was overcrowded, and the prisoners admitted were suffering from the effects of the prevailing scarcity.

General Population.

General Remarks.—Those whose duty or interest in the subject has led them to a perusal of this section in previous years will be acquainted with the difficulties that confront the vital statistician when dealing with the figures presented in the annual reports of the provincial Sanitary Commissioners.

In view of the recent orders of the Government of India to bring the remarks on this subject within a briefer compass, it is not considered desirable to restate these difficulties, and to those unacquainted with the conditions a reference to the report for 1899 is recommended. But it may be said that as regards the year's results now to be reviewed the prospect of arriving at exact conclusions must necessarily be more remote from the fact that the census figures of 1891 are still the basis of calculation of the birth and death rates and of the quinquennial averages, and that the calamitous famine, which directly affected four large provinces and, indirectly, others, has profoundly altered the population figures both in actual numbers and in distribution.

And in addition to famine, pestilence in the form of cholera and epidemic fevers which prevailed to an extent without a parallel in previous records, has introduced another vitiating factor into the account of inestimable force. Beyond the extra loss of life thus involved over and above what may be deemed due to "natural causes," the effect of these visitations in setting up tides of immigration and emigration would suffice to impair the validity of the best accredited registration returns. But we know that, as regards the effect of cholera, the returns are defective, and although many of the deaths so caused have doubtless been reported under other heads, it cannot be doubted that a considerable number have escaped all record. If to these considerations be added the fact that at present nothing is certainly known of the alteration in the distribution of the population due to the more permanent and normal inducements to change domicile which have operated during the decade, it will be admitted that close reasoning based on the recorded ratios is a task beset with fallacies.

The census of 1901.—The final enumeration of the census of India was made on March 1st, and the provincial totals were published just two weeks later, a remarkable feat due to the adoption of a new system and to the perfection of the arrangements made by Mr. Risley, C.I.E., the Census Commissioner; unfortunately the provincial sanitary reports are compiled for the most part during the first quarter of the year, and the new figures will not be taken into general use until 1902. It has subsequently transpired that the corrected totals vary from those first announced to an altogether infinitesimal degree, and the broad results may be stated, while at the same time no attempt will be made in this report to discuss their significance in detail, a task that must be reserved till after the publication of the final and full results by the Census Commissioner.

So far it is known that the population of all India, British and Native territory, has risen in the decade from 287,317,048 to 294,266,701 giving an increase of only 2·42 per cent., which, however, on account of the inclusion in the gross total for 1901 of the population of several outlying tracts* never before enumerated, gives an unduly favourable result; comparing the areas actually enumerated in both census years, the increase in the latter amounts to only 4,283,069, a rate of 1·49 per cent., as compared with an actual rate of increase of 11·2 per cent. in the previous decade.

But this result is again considerably modified if we differentiate between British territory and Native States; in the latter the aggregate population has fallen off by nearly 3 millions, *i.e.*, by 4·34 per cent. on the population of 1891, which stood at 66,050,479, while the actual increase of nearly 10 millions in the former, from 221,266,569 to 231,085,132, is at the rate of 4·44 per cent.

The figures for the different Native States are terribly significant of the effects of famine, which were not alleviated, to anything like the same extent as was found possible in British territory, by organized measures of relief; for this we must look partly to the smaller financial resources of these States, to the greater extent to which they suffered, as a rule, from the failure of the monsoons and to the lower standard of living and the less resistant powers of the aboriginal tribes. Baroda shows a decrease of 19 per cent.; the Bombay States one of 14 per cent.; Rajputana and the Central India States suffered

* Shan States and Chin Hills: Sikkim; Kurram Valley; Baluchistan Agency; Bhil tracts and Rajputana; Nicobar and Andaman islands.

losses of 18 and 17 per cent. respectively, figures which are far greater than those afforded by any of the British provinces, the details for which are given in the accompanying statement :—

Province.	Census variation per cent. 1881-91, + or —.	Population as shown by the census. 1891.	1901.	Census variation per cent. 1891-1901, + or —.	Natural increase or decrease as shown by excess of recorded births over deaths, or vice versa. Total Births 1891-1900.	Total Deaths 1891-1900.	Difference.	Percentage natural increase or decrease, + or —.
1. Burma, Lower ...	+23·58	4,408,466	5,371,328	+21·84	1,360,361	1,056,735	+303,626	+6·8
2. Assam...	+11·31	5,433,668	6,122,201	+12·67	1,606,764	1,733,679	—126,915	—2·5
3. Madras	+15·58	35,630,440	38,208,609	+7·24	9,513,153	7,127,850	+2,385,303	+7·2
4. Punjab	+10·71	20,866,847	22,449,484	+7·58	8,446,435	7,059,027	+1,387,408	+6·8
5. Bengal	+6·89	71,346,961	74,713,020	+4·72	24,390,880	22,340,462	+2,050,418	+2·9
6. Coorg	—2·93	173,055	180,461	+4·28	40,030	52,540	—12,510	—7·2
7. North-Western Provinces and Oudh.	+6·34	46,904,791	47,696,324	+1·84	17,695,271	15,312,988	+2,382,283	+5·1
8. Bombay	+14·34	18,873,342	18,584,496	—1·53	6,427,142	6,668,689	—241,547	—1·3
9. Berar	+8·41	2,897,040	2,752,418	—4·99	1,093,157	1,243,960	—150,803	—5·4
10. Central Provinces ...	+9 61	10,784,294	9,845,318	—8·71	3,387,780	3,767,960	—380,180	—4·0
TOTAL	+9·5	217,318,904	225,923,659	+4·0	73,960,973	66,363,890	+7,597,083	+3·6

Here again we cannot avoid the conclusion that famine and prolonged scarcity have played a chief part in producing the extraordinary variations in the actual increases and decreases, though subsidiary factors have doubtless been in operation. The first two areas on the list have certainly been free from famine and plague, but both have the advantage of a considerable and constant influx of immigrants. Madras has suffered from scarcity (in 1896-97 and again in 1899-1900), plague, though not widely epidemic, has figured in the returns of 10 districts, and it has lost by emigration to an extent not at present known.

In the Punjab famine was prevalent in some 10 districts in 1899, which returned to these and extended throughout three other districts in 1900, when scarcity was elsewhere generally felt; plague may be said to have been endemic in at least two districts since 1897, while cholera prevailed widely in 1892 and 1900.

In Bengal, while actual famine has not declared itself, widespread scarcity and high prices have been a feature of its economic history during three of the ten years; plague has claimed a larger number of victims than the records take account of, and cholera is reported to have been the cause of about 1,300,000 deaths in five of the ten years in question, a number nearly equal to the death-roll of the previous decade from this one cause. In the North-Western Provinces famine, which had prevailed in Bundelkhund in 1896, extended over a much larger area in 1897, while to cholera 542,000 deaths were ascribed in the three years 1891, 1892, and 1894, a number which is little short of the total for the whole of the previous decade from this cause. As to the Bombay Presidency, Berar, and the Central Provinces, the history of the first has been writ large in the public journals; plague has been endemic for five years, famine and scarcity have been superadded, and in five of the ten years cholera has been exceptionally prevalent. In Berar the year 1897 was one in which the people stood upon the verge of famine, and in 1900 famine was at its worst throughout the year; in four of the ten years cholera was abnormally severe. Lastly, in the Central Provinces the people have passed through two of the severest famines on record, from the autumn of 1896, throughout 1897, and in 1900; five of the ten years were also marked by exceptionally heavy cholera epidemics.

It is certainly not desirable, nor is it desired, to minimise the significance of the facts disclosed by the recent census; the above sketch of the untoward conditions against which

the people have had to struggle, if it affords a knowledge of the proximate causes, serves at the same time to direct attention to the economic conditions and sanitary shortcomings under which existence is passed by masses of our fellow-subjects, and which a failure in the supply of the natural fertilizing agent of the soil and of the prime necessity of life—water—brings out with such lamentable emphasis. For the facts set forth are susceptible of only one interpretation as regards the proximate cause of a situation that is receiving the earnest attention of the Government of India. Those parts of India, British or Native, which are adequately watered naturally or artificially, and which escaped famine, show an advance, modified doubtless in parts from their physical and economic relations to the rest; while those where rain is under ordinary circumstances capricious and scanty, and where in the last half of the decade it may be said to have failed, and where there are no systematic irrigation works, we have the famine areas with consequent mortality, emigration, and impaired fecundity, all inducing a decline in population.

Allusion has been made to the capricious as well as to the scanty character of the rainfall, to which many parts of the country are frequently subject. And truly it may be said that the results of an ill-distributed and superabundant precipitation are on the whole more disastrous than even drought: they are certainly more dramatic and ultimately more tragic and exhausting. The effects of floods and of the consequent epidemic fevers are writ large in the statistical annals of the year and of the decade, and, if the truth could be demonstrated, it would be evident that the people have suffered more severely, directly and indirectly, on this account than from famine and its results. Beyond the immediate prostration by fever of practically the whole population in areas subjected to floods, so that agricultural operations are suspended, and whole tracts thrown out of cultivation, there is the terrible mortality and the long persistent debilitation of the survivors which has a far more marked effect in impairing fecundity, and so of delaying restoration, than famine. One example of this state of affairs is cited later in this section, but these facts must be borne in mind in endeavouring to appraise the causes that have led to some of the remarkable results disclosed by the census.

If we take the nine provincial areas under registration in British India (excluding Burma) we find a net increase during the last decade of 7,641,893; had the natural increase followed in the same proportion as in 1881–1891, the number would have risen to 20,271,548; that is to say, there are over 12½ millions, distributed thus: Bombay, 3 millions; Madras, 3 millions; Central Provinces, 2 millions; North-western Provinces and Oudh, 2 millions; Bengal, 1½ millions; Punjab, ⅔ million; Berar, ⅓ million,—less than under ordinary conditions might have been expected. But it is altogether fallacious to take this figure as the measure of the direct loss due to excess mortality. Account must be taken of the effect of migration and of the lessened fecundity, due to famine and scarcity, on the birth-rate, that is to say, we have to distinguish between loss from excess mortality and a diminished source of supply. A reference to the birth statistics of the affected areas will show how far short of the normal expectation recruitment fell during the last half of the decade, with the notable exception of the year 1899, having due regard to the natural increase in the population since 1891. But neither the actual numbers nor the millesimal rates represent the truth in any year; the births registered may roughly be said to fall short of the true number by from one-third to one-fifth in different provincial areas, and the difficulties in arriving at any reliable estimate of the loss caused by a lowered birth-rate are very great. But a study of the available data, read in the light of this knowledge, would appear to indicate that under the stress of famine and pestilence there were at least some five millions fewer children born than might have been expected under ordinary conditions, this figure being arrived at provisionally and pending the further light which the Census Commissioner will doubtless throw upon the subject. In endeavouring to arrive at an estimate of the true loss from this source, account must be taken of the mortality which this number of infants, if born, would have suffered, which may be put at from one-third to two-fifths of the whole in the first year of life.

While we repeat that no one can study these results without grave concern, it must be admitted that the outlook has some redeeming aspects. Newspaper critics, whose conscientious sympathy one may well respect, have pointed to the actual and the might-have-been as indicated by the last two census returns, and have deduced a wholesale loss to the population without alluding to any modifying factor or its source and without discriminating as to its results. It has been shown that the estimated loss is, to a large extent, not to be attributed to excess mortality, and it may be added that the period of enforced celibacy and physiological rest will have its reaction on the return of normal conditions; fecundity will be increased, and in this sense a considerable part of the "loss" is in the nature of a deferred interest or increment which will later appear in the

account. The birth-rate may be expected to rise by one-fourth or one-fifth on the normal in the year following restoration, and to a smaller extent in the subsequent year, and this will probably mean an addition of some three millions to the population in British territory only, and beyond the normal increase (see section V. of Annual Report for 1899, pages 103–106). Beyond this, regrettable as the loss by excessive mortality has been, it is not a theoretical assumption that this has fallen to the largest extent on the unfit, the diseased, the unproductive, on those who consume at the expense of the productive, and who are a burden of more than the proverbial feather's weight when the balance between income and expenditure is so narrow. The facts furnished by the history of the Central Provinces, which are given in some detail under the provincial sub-section, may be considered in support of this assertion. If, as we may perhaps reasonably hope, the cycle of deficient and ill-distributed rainfall has worked itself out and a cycle of normal conditions is to to set in, we may at least congratulate ourselves that we enter the new decade with a population much better equipped for the ordinary struggle of existence, more resistant, and with a disproportionate number in the reproductive age periods, which will by being less subject to mortality further tend to ensure a balance of increase.

Indeed, the considerations of gravest concern to which a study of the vital statistics and of the habits of the people give rise are, perhaps, those which are at present inherent in the normal conditions, and especially one would point to the high infantile mortality rate which accompanies prosperity and to the undoubted fact that though the large majority of the people are at a great disadvantage in the struggle on account of deficient nourishment on which powers of "resistance" so largely depend, yet it may be asserted that the physiological value of the food ration they usually obtain is ample to sustain that measure of health which depends on a sufficient supply of nourishment. The explanation of this paradox lies in the nature of the food to some extent, but more largely on its methods of preparation from the stage of the raw grain to the stage when it is considered fit for consumption in the universal form of unleavened cakes. The grain is, as a general rule, dirty and very imperfectly ground and sifted, and cooking is but half consummated, so that much of the food is literally consumed raw with adventitious indigestible material; defective mastication is also a common and serious factor in the sum of the causes that go to produce the economic loss, which in the aggregate is enormous, especially when the proportion of unassimilated proteid in vegetable food is considered. Any one who has conducted sewage purification experiments in this country will confirm these views; it is not only that the average weight of the daily solid excreta is on the average quite $2\frac{1}{2}$ times that of the European on a mixed and well-cooked diet, but that in the excreta are incorporated a quantity of raw or semi-digested food materials. This is not only so much food value lost, but, as shown by the habitual double daily evacuation, the energetic peristalsis set up is inimical to the full assimilation of the rest. The art of cooking receives very little attention, and, indeed, has developed, among the masses, little beyond the stage of primæval man, and when the food consists almost entirely of grain and pulses this defect is the more serious, for adequate cooking goes far towards producing the results which it is the function of the digestive organs to complete. It is therefore not difficult to understand why bowel complaints occupy such a prominent place in the true causes of mortality and why the natural resistance to all forms of disease is wanting. It is in this direction, as well as in the reform of marriage customs, in the diffusion of knowledge as to the care of infants, and in the awakening of the spirit of enterprise that will lead the surplus population of congested areas to seek fresh and freer fields elsewhere, that "civilization" in its best sense has so large a part to play for the welfare of the people of India. These are reforms that can only come from within, but while the fundamental functions of self-preservation and propagation are either so misunderstood or so misapplied, the vital statistics will always bear the stamp of a lamentable waste of lives.

As regards the effects on the records of mortality, of famine and pestilence during the year under review, the reader is referred to the admirably careful and lucid discussion of the subject presented in the Report of the Famine Commission of 1901. In a final summary the total number of deaths recorded in the five actual famine areas (British) during the year 1900 is compared with the decennial average number and a balance of excess to the extent of about $1\frac{1}{4}$ million deaths is exhibited against the year under review. But, as has been pointed out, the number was inflated to a large but unknown extent by the deaths of immigrants from Native States, who came across the borders in a deplorable state—often in a dying state. The impression left by the evidence was that one million excess deaths occurred among British subjects, and that at least one-fifth of this mortality was due to cholera alone.

Referring to the census table on page 70, it will be noticed that the "variation per cent." based on the registration returns of births and deaths, is in some cases very similar to the actual variation per cent. as disclosed by the census; in other cases there is a strong contrast. It need only be said here that no reliable indication of the correctness or defectiveness of registration is afforded by this comparison. This important question is about to be examined critically on receipt of the full and final Census Report, which, among other data, will furnish estimates of the gains and losses in each province by migration, and the general results will be set forth in the Annual Report for 1901. Apart from the disturbing effect of migration, it may merely be noted that even where registration is notoriously defective a variation based on the records may approximate closely to that disclosed by the census if the registration of the births and deaths is proportionately defective. If the recorded average birth-rate is 30 per 1,000 against a true rate of 45, and if the recorded death-rate per 1,000 is 22 against a true rate of 37, it is obvious that the "natural increase" is the same in both cases. To mention only one case, viz., that of the Madras Presidency, the variation by natural increase based on the records is 7·2 per cent., and the census variation is identical, yet there is abundant evidence to show that registration is defective, if not to the precise extent, yet in the nature of the example just quoted. The whole subject is beset with difficulties, which arise partly from the great variations in the effectiveness of registration in different areas, and no one modifying factor applying generally, and partly from the extraordinary variations exhibited by the recorded "actuals," which are truly "tropical" in their ebb and flow under stress of the changing conditions of life. No better evidence of this can be desired than the figures recorded in most provinces during the last three or four years, and some striking examples are quoted in a subsequent part of this section. Taking the Central Provinces during the last five years we get the following birth and death rates :—

—	Birth-rate.	Death-rate.	Natural increase or decrease.
1896	31·72	49·31	−17·5
1897	26·83	69·34	−42·5
1898	29·91	24·30	+ 5·6
1899	47·35	28·09	+19·2
1900	31·90	56·75	−24·8

Nothing could testify more eloquently to the vicissitudes under which the people have lived and died, while at the same time the actuary and the vital statistician may well find themselves at a loss before the uneven tenour of these figures.

Before leaving the subject of the preliminary results of the recent census, allusion may be made to a feature of great sanitary interest disclosed by the figures returned for a large area in the Western Doab (the Ganges-Jumna Mesopotamia) of the North-Western Provinces. The area comprises some eight districts where canal irrigation is systematically carried out, with the consequence that up to the early part of the last decade water-logging of the soil was a general feature of the country. Not only had the fertility of the soil deteriorated by the efflorescence of "reh" in many parts, but the prevalence of fatal forms of fever laid a heavy tax on the life of the population, and when the census of 1891 was taken it was found that in the four northerly districts the population had only advanced by 3·4 per cent. on the figures of 1881, against an average of 6·34 for the whole province, and this in spite of a never-failing series of good harvests. But the four southern districts, which had also suffered from floods and the epidemic fevers consequent thereon, actually showed a decrease of 4·3 per cent., and in the early "nineties" the revenue assessments in many villages had to be revised and reduced owing to the depopulation and the poverty induced by disease and by the deterioration of the soil. Since then drainage operations on a very extensive scale have been undertaken, many hundreds of miles of drainage "cuts" having been made, and beyond this, the alignment of many of the irrigation channels having been redressed. The results of this

beneficent policy are apparent in the new census figures; the percentage increase of population in the first four districts is no less than 14·4 per cent., and in the lower four districts 12·2 per cent., the most astounding contrast with the previous census results being furnished by Etah, perhaps the most severely affected in the former period. At the census of 1891 the percentage *decrease* for the decade was given as 7·25, while at the recent census the population of this district was shown to have increased to the extent of 23·09; doubtless emigration in the former period and immigration in the latter played a considerable part in the results. As has been observed, one can scarcely doubt that the cost of the drainage cuts and of the remodelling of the canal-channels will be more than repaid by the increase of assessment which the increased cultivation in this area will probably admit of in the revenue settlements now in progress. The people of this area have enjoyed complete immunity from anything approaching scarcity in contrast to the lot of their fellows in other parts of the province and in the Punjab, and indeed they have reaped a rich harvest in ministering to the necessities of the latter from the ample stock of suplus food grains at their disposal. The object lesson is one of great importance and of far wider application.

The following statement furnishes a brief epitome of the Birth and Death Statistics recorded in 1899 and 1900 :—

Birth and Death Statistics.

Province.		Total number of births registered.	Ratio of births per 1,000 of population.	Mean ratio of births per 1,000 during previous five years.	Number of deaths registered.			Ratio of deaths per 1,000 of population.			Mean death-rate during previous 5 years.			Number of deaths of males to every 100 deaths of females.
					In Municipalities and towns.	In Districts, excluding towns.	Total.	In Municipalities and towns.	In Districts, excluding towns.	Total.	In Municipalities and towns.	In Districts, excluding towns.	Total.	
Bengal	1899	3,053,178	42·96	35·63	114,593	2,103,650	2,218,243	33·10	31·11	31·21	33·56	31·91	31·99	113·
	1900	2,749,582	38·68	37·66	151,015	2,452,721	2,603,736	43·46	36·28	36·63	33·00	31·17	31·26	113·
Assam	1899	179,027	35·45	31·58	4,073	152,522	156,595	37·29	30·87	31·01	45·01	37·33	37·50	117·09
	1900	184,427	34·96	30·63	3,961	157,670	161,631	38·62	30·48	30·64	45·00	35·25	35·44	112·94
North-Western Provinces and Oudh.	1899	2,255,627	48·09	35·69	126,366	1,430,455	1,556,821	39·04	32·76	33·19	39·04	34·07	33·19	110·45
	1900	1,892,169	40·34	37·37	136,339	1,323,800	1,460,139	42·13	30·31	31·13	39·16	32·22	32·70	111·21
Punjab	1899	994,001	48·4	42·9	65,492	542,233	607,725*	32·58	29·23	29·57	35·31	31·50	31·89	107·2
	1900	843,970	41·1	43·8	109,674	870,537	980,211*	54·55	46·92	47·69	33·65	30·14	30·50	105·2
Central Provinces.†	1899	449,895	47·35	32·14	27,852	239,078	266,930	34·11	27·53	28·09	46·23	43·11	43·38	118·51
	1900	303,121	31·90	33·98	48,402	490,832	539,234	59·28	56·51	56·75	46·18	41·12	41·29	119·43
Berar	1899	144,034	50·5	36·0	15,178	98,814	113,992	42·6	39·5	39·9	42·9	42·3	42·3	111·8
	1900	89,302	31·3	39·4	31,041	204,981	236,022	87·2	82·1	82·7	43·1	41·8	41·9	115·3
Madras	1899	1,048,335	31·3	28·6	73,932	601,162	675,094	29·1	19·4	20·9	29·3	20·6	21·3	103·4
	1900	1,049,199	31·8	29·3	83,561	687,298	770,859	32·6	22·6	23·4	29·4	20·7	21·3	105·5
Coorg	1899	4,427	25·59	23·16	553	4,292	4,845	35·65	27·24	28·00	39·87	31·56	32·36	129·62
	1900	4,542	26·25	23·00	814	5,488	6,302	52·48	34·83	36·42	41·38	32·22	33·04	130·67
Bombay	1899	685,348	36·42	34·41	147,705	524,564	672,269	64·09	31·77	35·72	41·45	31·04	32·31	112·00
	1900	505,662	26·87	34·68	235,817	1,082,966	1,318,783	102·33	65·57	70·07	47·42	30·99	33·01	115·0
Lower Burma ..	1899	165,229	37·04	30·97	19,973	101,798	121,771	34·46	26·23	27·30	30·63	23·47	24·40	129·
	1900	171,183	38·37	32·86	19,487	103,227	122,714	32·70	26·71	27·51	31·10	24·25	25·14	128·

* Excluding Europeans and Eurasians. † Excluding Zamindaries of the Chhattisgarh Division.

Bengal.—In 1899 the total number of births registered in Bengal was 3,053,178, the highest on record, yielding a ratio per 1,000 of 42·96; in 1900 the actual number fell to 2,749,582, which is 38·68 on the old census population, and 36·95 on the figures just announced (1901), while the mean of the previous quinquennium is 37·66, which is, of course, not corrected for the increase in population; the birth-rate may therefore, be

described as fully up to the average of recent years. A falling-off in the number of births of 303,596 as compared with the total of the previous year, large as it may seem, loses its significance when the circumstances are considered; the high birth-rate of 1899 was due to a return of prosperity and plenty after a period of scarcity and wandering in search of work. During the later months of 1899 the tide again turned; scarcity and high prices began to prevail and extended through the year under review, and this, together with the excessive prevalence of epidemic disease, makes it a subject of congratulation that the birth-rate was, at any rate, fairly maintained at the recorded normal. This, then, was the outstanding feature of the general provincial birth-rate, and it will serve no useful purpose to contrast more closely the phenomena in different areas in the two years. The birth-rates in districts (including towns and rural areas) ranged from 49·19 per 1,000 in Noakhali, and 46·83 in Tippera, to 28·53 in Hooghly and 15·8 in Calcutta; in towns, we have, at one end of the scale, rates of 62·63 in Garulia and 56·23 in Joynagar, and at the other end 5·07 in Jhalakati and 4·94 in Nawabganj, all situated in or near the area of the 24-Parganas, and all subject to great fluctuations of population which make the recorded ratios fallacious.

As regards rural areas, Sherpur (Mymensingh) is credited with a rate of 57·66, and Chandpur (Tippera) with one of 54·86, while Nawabganj gives 20·49 and Serampore 16·93, and these last again are both in the Presidency area where as a general rule the sex-distribution and a floating population militate against high birth-rates, a subject that has frequently been discussed in these reports.

Throughout the province as a whole 105 males were born to every 100 females, but this proportion was subject to large variations in different areas.

The total number of deaths registered in 1900 was 2,603,736, which is 34·99 per 1,000 on the census population of 1901, but amounts to 36·63 on the old census figure (in either case the highest on record), against 31·21 in the preceding year and 30·12, the decennial mean (1890–99). While therefore in 1899 the births exceeded the deaths by 834,935, the "natural increase" in 1900 was only 145,846, a deficit of not far short of three quarters of a million. As we have seen, the birth-rate was extraordinarily high in 1899, and about the average in 1900, and, consequently, it is the rise in the mortality in the latter year which at once claims attention. Now, as regards mortality the year 1899 was about the average, but there were 385,493 more deaths recorded in 1900, an increase of about 5·4 per 1,000 on the last census population. The increase per 1,000 in the districts, excluding towns, amounts to 5·17, while in the towns (containing about 5 per cent. of the whole population) it rose to 10·3 per 1,000. The following statement exhibits the factors of this increase:—

—	Districts.	Towns.
Cholera	3·37	2·89
Small-pox	·08	·64
Fevers	1·28	2·91
Dysentery and Diarrhœa	·30	·93
All other causes	·19	3·02
	5·2	10·3

The cholera mortality is dealt with in a subsequent section of this report; 345,878 deaths were recorded from this disease, giving a ratio per 1,000 of 4·86, against 1·51 in 1899, and 2·5 the mean of the decennium.

To "fevers" are ascribed no less than 1,703,804 deaths, equal to 66 per cent. of the total mortality; this number yields a death-rate of 22·9 per 1,000 on the last census, the decennial mean (1890-99) being 21·8. In this respect, again, the year stands out as one of exceptional unhealthiness, the districts of Dinajpur, Jalpaiguri, Faridpur and Malda having as usual an unenviable pre-eminence, with death-rates ranging from 36 to 40 per 1,000 from this cause alone. The physical causes to which this high mortality is attributed, in the brief but graphic accounts furnished by the local medical officers, leave little room for doubt that true malarial fevers are a predominant factor in these

deplorable results; we read of the silting-up of rivers and the consequent stagnation of drainage water; of floods due to abnormally distributed rainfall; of large tracts of country becoming stagnant marshes in the monsoon period; and, for the rest, bad drinking-water from surface sources, and overcrowded ill-ventilated dwellings.

As might be expected with cholera everywhere epidemic, the same causes were in operation to raise the death-rate from dysentery and diarrhœa. To these diseases 64,664 deaths were attributed (0·86 per 1,000 on the recent census), whereas the mean for the decennium is only 47,304. As usual the urban rate was more than five times that of the rural, a result largely due to more exact diagnosis in the towns, and which suggests grave doubts as to the correctness of the returns, as regards the prevalence of bowel complaints, among the great mass of the population.

One of the striking features of the statistics of the last three years is the extraordinary rise on the mortality under "all other causes." In 1898 the total returned was 320,081; in 1899 it rose to 413,301, and for the year under review it is 436,568. The increase is more notable in urban than in rural areas, and must be considered too large and too sudden to be altogether referable to improved diagnosis. It is significant that this great rise has been synchronous with the prevalence of plague, and that about 40 per cent. of all this excess mortality since 1898 was returned from one division, Patna, where plague has been endemic. It is well known that deaths from plague are often ascribed by the people to any and every other cause, to stave off preventive measures, and when the medical history of the year is summed up, the conclusion can scarcely be avoided that plague, which is dealt with in a subsequent section of this report, has been second only to cholera as a cause of the extraordinary transformation that the vital statistics have undergone.

As regards the death-rates reported for the different sects, Muhammadans and Hindus suffered at the rate of 38·36 and 36·48 per 1,000, respectively; Christians follow with 27·06, then Buddhists with 26·58, while Other classes, for whom the returns are least reliable, died at the rate of only 23·36 per 1,000.

Assam.—The year 1900 was one in which the number of births recorded was considerably above, and the number of deaths considerably less than, the decennial average, which was however raised by the enormous mortality of 1897; if this year be excluded, the number of deaths in 1900 is quite up to the average. There is however some justification for congratulation on "a fairly healthy year," if only on the ground that it was one of the three in the decade in which the births exceeded the deaths. If the total number of deaths registered in Assam during the 10 years 1891–1900 is set against the total number of births, a natural decrease of 126,915 or 2·5 per cent. is exhibited. The new census however shows an actual increase of 688,533 or 12·67 per cent. To what extent this increase is due to immigration cannot be estimated until the Census Report is available, but the province has not suffered from famine or scarcity and is, indeed, considered to be free from the risk of such a calamity, and the contrast exhibited above must, to a considerable extent, be attributed to defective registration of births, of which the returns exhibit abundant evidence. The alternative conclusion is that the natural conditions of life in Assam are so bad as to rapidly lead to depopulation by excessive mortality, which is not warranted by the evidence available. This question will be dealt with in a survey of the results of registration of vital statistics in the different provinces based on the disclosures of the recent census which will be instituted by order of Government when the full census report is available.

The total number of births recorded was 184,427, a ratio of 34·96 per 1,000 on the recent census figure; in the previous year the actual number was 176,770, or 35·5 per 1,000 on the uncorrected population, the mean of the quinquennium being only 30·63. When the figures for the two great valley areas, into which the province is naturally divided, are examined a notable difference is disclosed; the Surma Valley yielded a birth-rate of 39·14 and a mean of 33·07 for the previous 5 years, while the Brahmaputra Valley returned a rate of only 30·73, which is only about 2 per 1,000 above the quinquennial average. This great contrast is largely due to imperfect registration in the latter area, though doubtless epidemic disease has been more prevalent, and the general standard of health and of living are lower, in the Brahmaputra Valley. The question of registration is however one to which the Government of India have directed the serious attention of the local authorities with a view to the reconsideration of the employment, for this purpose, of unpaid village headmen, or if this agency be found

indispensable, to the adoption of more stringent control and check of their work. In this respect there appears to be room for great improvement, as a study of the returns furnished by the Police and the Vaccination Staff abundantly proves.

The total number of deaths rose from 154,326 in 1899 (ratio 31·0 per 1,000 on the old census figure) to 161,631 or 30·64 on the population enumerated in 1901, the mean of the previous 5 years being 35·44 per 1,000. While the quinquennial averages recorded for the two valleys are 36·08 for the Surma and 34·80 for the Brahmaputra, the death-rate in the former in the year under review was 29·9 against 31·39 for the latter. The districts of Nowgong and Darrang in the latter area stand out from the rest with rates of 53·03 and 44·09 respectively, and this is due to the prevalence of cholera and fevers in epidemic form. The history of the former disease is detailed in a subsequent section of this report, but it may be noted here that 60 per cent. of the total mortality from this cause in the valley occurred in these two districts ; 24·95 per 1,000 of the population were reported to have succumbed to this disease in Nowgong and 9·6 per 1,000 in Darrang.

To "fevers" 77,557 deaths altogether were ascribed, giving a death-rate of 14·7 per 1,000 of population against a quinquennial average of 20·13, and this includes 9,036 deaths from "Kala-Azar," which recent research has shown to be probably a malignant form of malarial fever. The disease was first recognized in Nowgong in 1891, and during the last seven years no less than 65,590 deaths have been ascribed to it in this district ; it subsequently spread to Darrang, Kamrup, and Goalpara, all in the same valley, and it has recently made its appearance in Sylhet in the other valley. It is satisfactory to be able to report that the mortality which averaged annually 16,138 in the four districts named for the five years ending 1899, fell in 1900 to 9,012, of which about one-half were reported from Nowgong alone.

The average death-rate in districts was 30·64 per 1,000, for towns 38·62, and for rural areas 30·48, and a comparison of these figures affords further evidence of the defectiveness of registration among the bulk of the population. The towns in Assam are comparatively small, nineteen having an aggregate population of only 102,574, and the conditions cannot be greatly dissimilar to those prevailing in the rural areas with which they are associated. Taking the mean rates for the last 3 years the following contrast emerges :—

——	Cholera.	Small-pox.	Fevers.	Dysentery and Diarrhœa.	Other causes.	All causes.
Rural	1·7	0·5	15·1	2·4	7·5	27·5
Urban	3·0	0·3	18·1	6·0	9·8	37·8

The excess of 10 per 1,000 in the towns, amounting to over 36 per cent. on the rural rate, is significant, if not convincing, of the failure to secure full reports of vital phenomena in the villages.

For the different sects the death-rates were as follows :—Other classes, 54·67 ; Muhammadans, 30·71 ; Hindus, 26·76 ; and Christians, 25·64.

North-Western Provinces and Oudh.—The number of births registered in 1900 was 1,892,169, against 2,255,627 in 1899, the millesimal ratios being 40·34 and 48·09 respectively, calculated on the uncorrected census figure of 1891 ; on the new census the rate amounts to 39·7, and the quinquennial mean is 37·37, so that all that can be said is that while the extraordinary fecundity displayed in the previous year (due to the circumstances fully described in the last report) has not been maintained, the birth-rate is well above the average. In 25 districts the rate is above, and in 23 below, the average for the province, and once again, the Western Doab area, where irrigation is very generally in operation, holds pride of place. The only noticeable features of what is described as a healthy year are the very low rural death-rates in the Kumaon (26·4), Lucknow (27·4), Allahabad (28·0), and Gorakhpur Divisions (24·6), and, with this, the comparative rise in the birth-rates generally in the eastern and central areas of the province, where, as a rule, they are notably lower than in the western area.

The deaths numbered altogether 1,460,139 against 1,556,821 in 1899, giving ratios of 31·13 and 33·19 respectively, against a quinquennial mean of 32·7. On the new census figure the rate for 1900 is 30·6.

The Sanitary Commissioner remarks that "there is no great departure from the average to call for any special comment beyond the fact that the year was a healthy one, although not free from epidemic disease." It must however be pointed out that the urban mortality was exceptionally high. The quinquennial mean for all towns having a population of 10,000 and upwards is 39·16, but in 1900 it rose to 42·13, while the rural rate for the whole province was only 30·31. Forty-eight of the 99 towns return death-rates above the quinquennial (urban) mean, eighteen have rates of over 50 per 1,000, and in 24 more the rates are between 40 and 50. That nearly 50 per cent. of all the municipal towns should record this high mortality, while doubtless indicating effective registration, is also suggestive of specially untoward conditions to which the urban population is subject, especially when the year is pronounced to have been "healthy."

Cholera, which is dealt with in a subsequent section of this report, is reported to have caused 84,960 deaths (1·81 per 1,000), the most considerable outbreak occurring in the Sultanpur district, where there were 17,174 deaths, equal to a rate of 15·96 per 1,000 of population.

To fevers 1,106,030 deaths were attributed (23·58) against 1,245,260 (26·55) in the previous year, the quinquennial mean ratio being 25·89. The districts most severely affected were those situated in the canal irrigation areas and those bordering on the notorious Tarai. Much has been done to secure the adequate drainage of the former, with a result which has been noticed in the prologue to this section (see page 73), but it is almost inevitable that the inhabitants of irrigation districts should pay for their abundant crops by a somewhat greater incidence of malarial fever.

The mortality from dysentery and diarrhœa was slightly higher, and that from "all other causes" notably less, than in the previous year, and, as regards the former, considerably less than the quinquennial average.

The death-rate among Muhammadans was 30·89 against 31·55 in 1899; among Hindus, 31·22 against 33·52; among Christians, 13·79 against 11·62; while among Other classes it was 22·61 against 18·36 in the previous year.

Punjab.—If we compare the births and deaths registered in the Punjab in the last two years, the following striking result is shown:—

—	Births.	Deaths.	Increase or decrease.
1899	994,001	607,725	= + 386,276
1900	843,970	980,211	= — 136,241

Now the average annual number of births registered for the decade was 844,643, and of deaths 705,902, so that the births in 1900 were up to the average, while the deaths were in excess by 274,310. While this leaves out of account the increase due to a larger population, it focusses fairly the main features of the vital statistics for the year, viz., an average birth-rate, and an excessive death-rate.

The births give a ratio of 37·76 per 1,000 on the new census, and one of 41·1 on the population of 1891, and this is 7·3 below the rate returned in 1899, a year of exceptional fecundity, and even at the reduced figure the Punjab maintains its foremost position in this respect. As compared with the previous year there was a notable falling-off in twelve districts, and this is justly attributed to severe famine in some, to scarcity in others, and to general movement of population from most of these. On the other hand, in no less than 14 districts out of the 31, the birth-rate was actually above the quinquennial mean.

In spite of a considerable disproportion between the sexes in the Punjab, and in spite of notoriously defective registration in the frontier districts, the provincial rate is always exceptionally high in comparison with that of other provinces; the ratio for the past decade calculated on the population of 1891 works out at just over 41 per 1,000, and if the calculation be made on double the female population, it rises to 44·3 per 1,000. This is doubtless partly due to efficient registration over the Cis-Indus area, and for the rest we must look to factors of race, to marriage customs and environment, including food. In the famine-affected areas the birth-rate fell off in different districts to the extent of from 8 to 20 per 1,000, but the population was so affected by emigration that it is impossible to make any exact deductions of the actual effect of the calamity in this respect, and the returns for next year must be awaited.

The total number of deaths recorded was 980,211, or 372,486 more than in 1899, and 274,309 above the decennial average. The ratio per 1,000 on the new census figure is 43·9 and 47·7 on the population of 1891, against 29·6 in 1899 and a quinquennial mean of 30·5. In 12 out of the 31 districts there was an excess of deaths over births ; Hissar heads the list with an excess of 71·8 per 1,000, then follow Ferozepore with 44·0, Rohtak with 35·2, Karnal with 33·9, Umballa with 24·5, Ludhiana with 15, Lahore with 12·6, Gurgaon with 11·6, Delhi with 10·4 and Montgomery with 7·8. These were the districts most severely affected by famine and scarcity and, to some extent, as a consequence, by epidemic disease, cholera and fevers, to which three causes the excessive mortality is attributed, and which gave rise to a death-rate of 96·4 in Hissar, 86·8 in Ferozepore, 73·7 in Karnal, 68·0 in Rohtak, 61·5 in Umballa, 60·4 in Ludhiana and 59·4 in Lahore district.

The average death-rate recorded in the towns was 54·55 against 46·92 in the rural circles. Some of the towns situated in the famine areas suffered very severely, but much has to be attributed to the confluence of refugees to relief works. Kaithal in Karnal (population 15,768) had a death-rate of 161·59, chiefly due to epidemic "fever" and to cholera ; Zira (Ferozepore) with only 4,356 inhabitants returned a rate of 160·47, of which fever accounted for 134·3 per 1,000 ; and Sirsa (Hissar) with a population of 16,415 lost 2,571, giving a ratio per 1,000 of 156·63, of which fever and cholera claimed the great majority. On the other hand, in the frontier districts many towns had a rate of less than 20 per 1,000.

The facts as regards the mortality from cholera are given in the subsequent section ; there were in all 28,260 deaths recorded from this cause (1·37 per 1,000), and considerably more than half the total were registered in five of the districts most severely stricken by famine.

Small-pox was just twice as prevalent as in the previous year, and here again the famine districts suffered most heavily along with Peshawar, where the disease is endemic.

The mortality ascribed to fevers accounted for 685,895 deaths or 70 per cent. of all recorded ; this number gives a ratio per 1,000 of 33·37 against 19·54 for the quinquennial mean. In Hissar and Forozepore the mortality amounted to 70 and 69 per 1,000 of the population respectively, and in Karnal and Rohtak it was over 50 per 1,000. All these districts were famine stricken, and the fatal form of the disease burst out with epidemic virulence in September "in consequence," it is said, "of floods due to excessive rainfall." In August the number of deaths recorded was 39,060, in September it rose to 66,351, and in the following months of October and November the appalling figures of 129,170 and 125,410 were registered. No details of any researches into the special pathology of the disease are recorded, but is believed to have been a malignant form of malarial fever acting on a population enfeebled by privation.

Dysentery and diarrhœa, as was to be expected, were more fatal than usual, and the increase over the average mortality was fairly general throughout the province, though it fell with special force upon the famine stricken areas.

It only remains in this brief review to give the incidence of mortality on the different sects. Hindus died at the rate of 52·83 per 1,000 against 30·7 in 1899 ; for Muhammadans it was 43·62 against 28·55 in the previous year ; for Native Christians 32·16 against 18·23 ; while for Other classes the enormous rate of 170·6 was recorded against 138·45 in 1899, but it is noted that the classification under this head is erroneous, and it may be added that there were only 6,067 persons included therein at the census of 1891.

Central Provinces.—The number of births registered during the year was 303,121, a decrease of 146,774 on the total of 1899, when, however, the highest number ever attained was recorded. The ratio per 1,000 of the population of the recent census was 30·8 and on the old census 31·9, against 47·35 in the previous year and a quinquennial mean of 33·98. The falling off then is not so great as might be expected in a year described as "one of dire famine and distress." In 1897 when famine was also widely prevalent "but in a less severe form," the number of births fell to 254,973, or 26·83 per 1,000, but it must be remembered that this rate was greatly influenced by distress and scarcity and even famine in the latter half of 1896.

All districts share in the decrease when the figures are contrasted with those of 1899, and in all save two the rate was below the decennial mean, and in all save five the number of deaths exceeded that of the births ; all over the province the "natural decrease" amounted to 236,113 or 24·85 per 1,000.

The causes to which these results are attributed are summarised by the Sanitary Commissioner as follows: severe and wide-spread famine, with all the "hard conditions of life" connated thereby, unsuitable and deficient nourishment and deficient clothing; epidemics of cholera, autumnal fevers and small-pox; a deficient and contaminated water-supply and the "special unhealthiness of the year due to heavy rain after unprecedented drought." To these may be added the distress consequent on the wanderings of large numbers of sickly and famished people in search of work and relief, which was complicated by the influx of unknown numbers of equally distressed people from over the borders. It will be obvious that the sum of these disturbing factors produced such alterations in the distribution of the population in the different registration areas that the purely local rates recorded afford no satisfactory indications for comparison with normal years, and a comparison with the famine year of 1897 is not likely to lead to useful conclusions, inasmuch as the vital statistics of that year were profoundly affected by the distress in 1896, whereas the two years antecedent to 1900 were a period of renewed prosperity and extraordinary fecundity. Thus it happened that when the people had to face the calamities of the year under review, they were as a body the survival of the fittest in the former struggle, fortified by a period of rest and good nourishment, while at the same time there was a far larger infantile population than in 1897. Here was its most vulnerable point, and we find that the tribute paid by the infantile section was far higher than in the previous famine. Altogether the age constitution of the population was radically altered by the previous famine and the subsequent prosperity, and in 1900 everything was in favour of far greater resistance to the renewed untoward conditions, save only as regards the infantile section. These considerations are supported by the general statistics of mortality, the main features of which are (1) a large excess over the mean, but a decrease when contrasted with the figures of 1897, (2) lower death-rates at all age-periods save the first (under one year) in 1900 as compared with 1897. It is not denied that the arrangements made for the supply of food and shelter and for all measures of amelioration which foresight and the experience of the previous famine dictated operated to a large extent in producing these results, but when all the facts are fairly considered, there can be no doubt that the previous calamity, followed as it was by a period of prosperity, contributed to the comparative immunity of the people in 1900.

Altogether 539,234 deaths were registered against 266,930 in the previous year and 658,822 in 1897, figures which yield ratios per 1,000 of 56·75, 28·09, and 69·34 respectively; it may further be noted that the non-epidemic mortality during 1900 was only 49·31 per 1,000, against 62·94 in 1897, which must be subject for congratulation, whether we look to the measures of relief afforded or to the natural immunity acquired by previous elimination of the most unfit. As compared with 1897 the death-rates were lower in 11 districts and higher in nine, the increase varying from 7·56 per 1,000 in Betul to 73·65 in Sambalpur, and, again, it is to be noted that where the rates had been lowest in 1897, these were, generally speaking, highest in 1900.

Calculated on the obsolete census population, the death-rate of children under one year of age was 580·19 per 1,000 for males and 506·12 for females; calculated on the number of births recorded during the year, the figures are 498·2 and 463·6 respectively. Keeping to the births as the basis, the mortality rates in 1899 were 241·5 and 215·7, and in 1897 they were 407·4 and 391·8 respectively.

As regards the chief diseases to which the people succumbed, cholera accounted for 63,114 deaths (6·64 per 1,000 of population), the highest number recorded since 1869, when a ratio of 10·5 was reached. Small-pox carried off 7,005 individuals, of whom 4,221 were children under 10 years of age, the ratio per 1,000 being 0·74 against a quinquennial mean of 0·42. The unusual concentration of children in relief camps and the influx of unvaccinated persons from Native States might have been expected to promote wide epidemic prevalence of the disease, but vaccination operations appear to have kept it in check.

To fevers were ascribed 272,683 deaths against 153,647 in 1899 and 389,335 in 1897, which yield millesimal ratios of 28·7, 16·17, and 40·98 respectively. The disease "appeared to be of the ordinary malarial type," and was most prevalent, as usual, during and after the rains; no cases of "famine" or relapsing fever were observed, though carefully looked for.

As was to be expected, the death-rate (5·16) from dysentery and diarrhœa was exceptionally high, indeed it amounted to double the decennial mean and to more than four times the rate for 1899 (1·25); it was, however, much lower than in 1897, when a rate of 8·53 was recorded. The figures, however, are so unreliable, and so many of the

deaths really due to these causes were ascribed to fever, that one can only derive an idea of their importance in the death returns from the fact that they were at least twice as fatal as in an ordinary year. The failure of the rains converted all water sources into "stagnant and stinking pools," and the people, deprived of their natural food grains, had to subsist on inferior and less wholesome substitutes.

Among Hindus the death-rate was 49·32 in 1900, against 25·46 in 1899 and 59·72 in 1897; among Muhammadans the respective rates for the same three years were 50·4, 29·87, and 52·61; similarly for other classes they were 99·48, 42·35, and 126·23 respectively, a comparison which is again favourable to the effects of the last famine.

Lastly, it may be noted that the important questions briefly touched upon in this necessarily cursory review of the effects of the famine on the vital statistics of the affected areas have received the most careful and detailed examination, but it is impossible within the limits set to this report to give the results in extenso; some of the main conclusions have been set forth in the prologue to this section and in this sketch of the figures furnished by the Central Provinces, but these should certainly be supplemented by a reference to the Report of the Famine Commission of 1901.

Berar.—This small Province, having a population of between 2½ and 3 millions, is contiguous to the Central Provinces, and the history of the year 1900 is very similar to that just related; a severe famine prevailed in a highly prosperous agricultural community which had never previously known straiter times than those brought about by high prices, and hitherto Berar has been considered free from any great risk of this visitation.

A simple comparison of the main vital phenomena recorded in the last two years will show the enormous fluctuations to which these are subject among a population living close to the soil and vibrating to the capricious processes of nature.

Year.	Births.	Deaths.	Increase or Decrease.
1899	144,034	113,992	+ 30,042
1900	89,302	236,022	—146,720

That is to say, there were 54,732 fewer births and no less than 122,030 more deaths in 1900 than in the previous year. The discussion of the significance of these figures is beset with difficulties owing to the intrusion of the unknown factor of immigration from Native States, and owing to the wandering of the indigenous population in search of work and relief.

The birth-rate, which stood at 50·5 per 1,000 in the previous year, fell to 31·3, the mean of the quinquennium being 39·4, these calculations being made on the census population of 1891; on the recent census figure the ratio for 1900 works out at 32·4, and a reference to the figures given for the Central Provinces will show that similar causes produced almost identical effects as regards the fecundity of the people. The highest district rate was returned by Wun, 34·2, and the lowest by Buldana, 26·9.

The total number of deaths recorded was 236,022, giving a ratio per 1,000 of 82·7 against 39·9 in 1899 and 41·9 the mean of the quinquennium, the increase being general in all districts; Basim, with 110·8, and Buldana, with 95·4, returned the highest death-rates, and it was hither that destitute refugees from Native States chiefly flocked, the lowest rates being 73·4 in Amraoti and 67·2 in Ellichpur.

The excess over the rates recorded in the neighbouring and probably equally affected Central Provinces is largely due to the fact that this was the first famine in Berar; scarcity due to high prices was the worst effect experienced in 1897, and consequently the process of elimination was very imperfectly effected in that year, and the people fell a ready prey to famine and epidemic disease, the death-rate being raised by the mortality among destitute refugees from outside.

From May to October, when conditions were at their worst, the people died at the enormous rate of 111·2 per 1,000 per annum. One of the notable features of this mortality was the severity with which it fell on the most robust age periods—between the ages of 10 and 15 it was nearly four times the normal, while for the combined procreative age periods (10 to 40 years) it was 2½ times the normal average; nothing could more clearly indicate the serious and searching nature of the distress when it is borne in mind that the total death-rate was only about twice the normal.

Turning to the infantile mortality rates, we find them rising from 231 in 1899, with a range of from 196 (in Wun) to 264 (in Ellichpur), to 490 in 1900; in Basim it was 619 and in Buldana 540, showing that in these districts considerably more than half the children born died within the year.

The urban mortality was at the rate of 87·2 against 82·1 in rural areas.

One of the severest epidemics of cholera on record afflicted the famished people, 18,375 deaths being recorded, or 6·4 per 1,000 against a quinquennial mean of 2·4, but the Sanitary Commissioner affirms his belief that probably 10,000 deaths from this disease were registered under other heads.

The mortality from "fevers" rose from 49,938 in 1899 (17·5) to 84·017 in 1900 (29·5); the increase being general in all districts, Wun furnishing the highest rate, 41·3, and Ellichpur the lowest, 20·7. Influenza was present in epidemic form, but there was no "famine" or relapsing fever; towards the autumn the type was definitely malarial, with hepatic complications and jaundice, and these cases were notably fatal.

Dysentery and diarrhœa, which accounted for 20,263 deaths in 1899, were reported to have caused no less than 63,860 deaths in 1900, this enormous increase being ascribed to the consumption of bad grain, which was removed from underground pits to meet the demand, as also to imported lentils, to which the people were unaccustomed, and to contaminated water.

The rise in the mortality ascribed to "other causes," which amounted to over 50 per cent. on that of 1899, was, it is said, chiefly due to the prevalence of lung diseases which followed influenza, and carried off large numbers of the very young and the very old.

Muhammadans, a very small section of the population, died at the rate of 66·8 per 1,000, against 36·4 in 1899; the rate for Hindus was 81·3, against 40·0 in 1899; for Christians, 128·9, against 27·1; and for Other classes, 140·1, against 44·4.

Madras.—The total number of births recorded during the year was 1,049,199, against 1,048,335 in 1899, and the ratios per 1,000 on the old census population are 31·8 and 31·3 respectively; it is at present impossible to say how the new census figures will affect these rates, as although the provisional total has been furnished, an unknown number, some two or three millions, are not under registration; it may, however, prove that the true birth-rate for the year is just under 30 per 1,000, the quinquennial mean being 29·3.

The birth-rate has shown a consistent tendency to rise throughout the decade to an extent not altogether due to the increase in population, and this must be attributed in part to better registration, a matter for which there is still room for considerable improvement. For here we have a large Indian population (some 35 millions in all) with a birth-rate on the estimated population, ranging during the last 10 years from 22·0 to 27·4 per 1,000, and yet increasing at a substantial rate. The recorded death-rates on the census population have similarly varied from 19·3 to 26·2 during the same period, so that if these figures could be accepted, the natural increase would be accounted for. Such low death-rates, however, at once throw doubt on the reliability of the registration returns, and a study of the statistics raises the strongest presumption that both births and deaths are gravely understated.

This is, indeed, the opinion of the Sanitary Commissioner, who last year affirmed that in the opinion of the registration agents the birth of an infant who did not survive the first year of life was often deemed unworthy of record, and again, on the other hand, "there is a tendency to ignore the deaths of infants." The low birth and death-rates and the wide range of variation in the rates in different areas are the outstanding features of the vital statistics of this Presidency, and obviously the pressing need is a reform in registration. To this end the new Act for compulsory registration of vital phenomena in villages was brought into partial operation towards the close of the year under review, 400 village communities being included in its scope as a first step, and it is scarcely too much to hope that surely, if slowly, a complete revolution in the character of the statistics may be looked for.

The City of Madras stands first, as usual, with a birth-rate of 46·1, and is followed by Chingleput District (near Madras) with 40·2, while the rates for Nellore and Cuddapah fall to 27 and 26·5 respectively, the urban average being 36·9, against a mean rural rate of 31·4. Where the birth-rate fell off in comparison with the previous year it is generally attributed to the effect of high prices inducing scarcity, which in four districts bordered on famine.

The deaths recorded in 1900 aggregated 770,859, or 23·4 per 1,000, against 675,094, or 20·1 per 1,000, in 1899, and a quinquennial average of 21·3. All save four districts shared in this increase, which is attributed chiefly to the unusual mortality from fevers and bowel complaints. The highest death-rate was recorded by Madras City (46·8), followed by the Nilgiris (34·4), while at the other end of the scale, Ganjam had a rate of 16·4, and for three other districts it was below 20 per 1,000. The average urban rate was 32·6, against only 22·6 in rural circles.

The infantile mortality rate, calculated on the births, rose from 159 in 1899 to 164·9 in 1900, with a range of from 115 in Malabar to 282·8 in the Nilgiris. An average rate which is less than that of France is obviously open to more than suspicion.

The death-rates recorded against the different sects are as follows:—Hindus, 23·5, against 20·3 in 1899; Muhammadans, 22·3, against 18·6; Other classes, 11·2, against 23·6; and Christians, 22·1, against 16·3 per 1,000.

The details as to the chief causes of mortality will be found in the subsequent section.

Coorg.—Under the instructions recently issued by Government for the condensation of reports, the materials furnished this year from the small province of Coorg are extremely meagre, and, indeed, consist, so far as at present available, of the bare tables of statistics. From these it appears that the total number of births recorded during 1900 was 4,542, or 26·25 per 1,000 of the population, the previous year yielding 4,427, or 25·59 per 1,000, and the mean for the quinquennium being 23·0.

The aggregate number of deaths, which was 4,845 in 1899, a ratio per 1,000 of 28·0, rose to 6,302 in 1900, or 36·42, as compared with an average for the previous five years of 33·04. The urban rate was 52·48, against 34·83 in rural areas. No fatal case of cholera was recorded during the year; small-pox accounted for 314 deaths (1·81 per 1,000), which is twelve times the average for the quinquennium; and for the rest it may be said that to "fevers," which carried off 4,840 persons, 77 per cent. of the total mortality is ascribed. The infantile mortality rates, calculated on the births, were 318 for males and only 260 for females, which suggests that many of the deaths of the latter are unrecorded.

Muhammadans died at the rate of 37·19 per 1,000, Hindus at 35·7, and Other classes at 65·44 per 1,000.

Bombay.—The history of this Presidency in 1900, as disclosed by the vital statistics, is a pitiable one, and all the more so that it is the climax of a long period of distress and retrogression due to the prevalence of pestilence and famine. The deaths exceeded the births in the year under review by no less than 813,121; the death-rate rose to 70·07 per 1,000, which is by far the highest on record, the highest annual rate during the previous 20 years having been 39·84 registered in 1897.

The birth-rate, on the other hand, was the lowest on record, having fallen from 36·42 in 1899 to 26·87, the decennial average being 35·32 per 1,000.

There would be nothing gained by contrasting the rates of the different local areas, or by instituting comparisons with previous years; famine or dire scarcity prevailed everywhere, save in the southern registration division embracing only four districts; and throughout the Sanitary Commissioner's report one is constantly baffled in trying to arrive at definite conclusions by the extraordinary movements of the population which are incidentally referred to. Famine drove large numbers to relief camps and raised the rates in poor-houses included within municipal limits; plague is said to have caused movements in the opposite direction, *viz.*, from the towns to the rural areas, to escape the sanitary regulations. Cholera caused large numbers to fly panic-stricken from one place to another, and beyond these inter-provincial ties there was probably a considerable outflow of emigrants. And this complex movement of the people has probably been to some extent in operation for the last few years, so that all deductions based on the distribution of the population in 1891, on which the rates are calculated, are subject to fallacies it would be impossible to avoid.

In 1899 the number of deaths recorded was 672,269, a ratio of 35·72 per 1,000; in 1900 the figures rose to nearly double, *viz.*, 1,318,783 and 70·07 per 1,000 respectively. This enormous mortality is referred to the different chief causes in the annexed statement.

which also affords a comparison with the mean of the quinquennium 1891–95, when normal conditions may be said to have prevailed.

—	Quinquennial mean, 1891–95.	1900.	Increase.
Cholera	24.416	163,889	139,473
Small-pox	2,656	9,885	7,229
Fevers	397,211	543,319	146,108
Plague	Nil	33,196	33,196
Dysentery and Diarrhœa ...	35,223	218,243	183,020
Other causes	91,053	342,027	250,974
		TOTAL EXCESS ...	760,000

Criticism is baffled in face of these figures, and moreover the Sanitary Commissioner furnishes evidence that they fall short of the truth. At the same time it is to be noted that of the total excess (762,298 deaths) no less than 610,959 deaths are distributed between two registration divisions only, the Western and the Gujarat ; in the former the death-rate is 82·96, and in the latter 156·47, per 1,000, and it was here that the effects of famine were most severely felt.

Cholera is dealt with in the subsequent section. The mortality from small-pox was the highest on record for the past 10 years, and the circumstances under which the people lived afford a sufficient explanation. The total number of deaths, given above, is equal to a ratio of 0·52 per 1,000 against a quinquennial mean of 0·12 ; in the City of Bombay it was 3·71, largely due to the influx of destitute refugees.

The deaths from fevers gave a ratio per 1,000 of 28·87 against 12·14 in 1899 and a decennial mean of 20·57, and this latter includes the plague deaths registered from 1896 to 1899. The mortality was greatest in the famine areas, and notably in Gujarat, in two districts of which the rates rose to 111·27 and 167·77 per 1,000, but these figures certainly include very many deaths from other causes. A careful investigation failed to produce evidence of relapsing fever save in Bombay City, where this disease has been endemic for years.

The deaths ascribed to dysentery and diarrhœa are equal to a ratio of 11·59 per 1,000 against a quinquennial mean of 3·07.

" The consumption of badly cooked or of raw grain, of grain to which the people were unaccustomed, and even of wild seeds, leaves and roots, . . . these are the chief causes, along with a deficient and contaminated water supply, of the epidemic of dysentery and diarrhœa."

The extraordinary rise in the mortality from " other causes " is attributed to the prevalence of plague, " which has made registrars careful not to put too many cases down to fever, which attracts enquiry " ; to famine ; and, to some extent, to improved registration.

The death-rate among Muhammadans was 43·59 per 1,000 against 26·98 in 1899 ; among Hindus, 77·36 against 38·12 ; among Christians, 52·64 against 38·66 ; among Parsis, 35·74 against 32·06 ; and among Other classes, 20·20 against 12·74 per 1,000 in the previous year.

Burma.—The annals of this province for the year 1900 afford a striking contrast to those of the peninsular areas it has just been our melancholy duty to discuss.

The extraordinary increase in the population during the decade has been alluded to in the prologue to this section, and though the facts as to immigration have not yet been disclosed, it cannot be doubted that the " natural increase " has played a predominant part in the result.

The total number of births registered in Lower Burma, which was 165,229 in 1899, a ratio per 1,000 of 37·04, rose to 171,183 in 1900, or 38·37 on the old census figure, against a quinquennial mean of 32·86. On the new census population the births recorded in 1900 give a millesimal rate of 31·8, and this is only one indication that the efforts made to register the simple vital phenomena are only very partially successful. This is a matter which is receiving the careful attention of the authorities, and a high standard at this stage of our relations with a comparatively recently acquired province and a shy people could scarcely be expected. The rates vary from 48·17 per 1,000 in Sandoway district and 47·96 in Pegu and 47·12 in Hanzada, to 32·93 in Akyab, 31·95 in Thaton and 17·43 in Rangoon City, the last result being largely due to the relatively small female population and to the floating nature of a large proportion of the whole population, this being the gate of Burma by which large numbers of emigrants enter.

The average urban rate is 27·55 against 39·06 in rural areas, the former being lowered by the very unequal sex-distribution of their population in many of the towns. For all this there are signs of greater care in registration in the rural areas than in the towns, and when the average rate in the 13 selected towns in Upper Burma (which can legitimately claim more indulgence) is found to be 36·87 per 1,000 of their population, the case for more energy in, and more stringent scrutiny of, the work of registration in the towns of the lower province is emphasised.

The record of births in Upper Burma is confined to 13 selected towns, the rate for which has been given.

The total number of deaths registered in Lower Burma was 122,714 against 121,771 in the previous year; the ratios per 1,000 on the census population of 1891 being 27·51 and 27·30 respectively, and the quinquennial mean 25·14. If the rate for 1900 is calculated on the new census figure, it amounts to only 22·8, which is scarcely consistent with the evident probabilities, with the evidence of defective registration which an examination of the statistics discloses, notably the wide range of variation in the total rates and in the infantile mortality rates.

The districts of Kyaukpyu and Myaungmya furnish death-rates of 33·31 and 33·20 respectively, while that for Rangoon City is 42·39; on the other hand the Mergui rate is 21·49, that for Thaton 21·34 and that for Prome only 19·59. In the towns the death-rates range from 48 per 1,000 in Myaungmya to 16 in Prome, the average urban rate being 32·7, while that for rural areas is 26·71.

Calculated on the births, the infantile mortality rates ranged in the five different divisions from 207·9 in Arakan to 135·14 in Tenasserim, figures which indicate approximately the attention paid to registration in the two areas. At the best the rates must be held to be gravely inaccurate, and when they are worked out for males and females separately, still greater anomalies are exposed. For instance, in Amherst district the female infantile mortality rate is only 83, and in Mergui only 97, and it is quite evident that while the deaths of many infants of both sexes are lost to account, the error is gravest as regards the females.

In Upper Burma, while only 13 selected towns return birth statistics, deaths are registered in a larger area comprising a population of about 2½ millions. The total number of deaths recorded in 1900 was 53,496, a ratio of 21·8 per 1,000, against 51,615 and 21·03 per 1,000 in the previous year; no quinquennial mean is available for comparison. The average rate for districts was 21·8 per 1,000, ranging from 32·91 in Kyaukse to 13·96 in Myingyan; the mean rate for towns was 32·83, and for rural areas 20·19. Registration is of so recent institution that further discussion of these figures is unnecessary, but it is hoped that, if only for purposes of education, the area under registration in the upper province will soon be extended, and this might, it is thought, be done forthwith as regards the births, if only to assimilate the population under registration for both births and deaths.

The incidence of mortality from the chief causes presents no special features of interest, the figures under each head approximating fairly to the average.

As regards the incidence on the different sects in Lower Burma, the record is as follows:—Hindus, 39·04 per 1,000; Burmese and Buddhists, 27·38; Muhammadans, 24·6; Other classes, 31·85; Europeans and Eurasians, 17·31; all these rates showing very little variation from those of the previous year.

History of Chief Diseases.

Cholera.

The distribution of cholera in India in 1900.—The mortality from cholera, which in 1898 and 1899 had been the worst on record during the eighteen years then concluded, rose with an appalling bound in 1900 to the highest total of which we have any authentic record. The number of deaths recorded in British territory, which was 152,703 in 1898, giving an average ratio per 1,000 of the total population under registration of ·70, rose to 171,410 in 1899 (ratio per 1,000 ·78), which, however, is considerably less than the average annual mortality in the single province of Bengal. In 1900 the number of deaths registered reached the enormous figure of 797,222, equal to a ratio per 1,000 of 3·7 as compared with the quinquennial mean of 1·5. If the returns from Native States be included, and if defective registration be allowed for (and many deaths from this cause escaped recognition or were returned under other heads in the tracts affected by famine), there can be no doubt that the true aggregate number of victims exceeded 900,000.

This exceptional prevalence of the disease was very generally, if not equally, distributed all over India Proper, but in Burma the mortality was considerably less than the average. It will be remembered that an exceptional feature of the epidemicity of cholera in 1899 (see report for that year) was the abnormal incidence upon the last quarter, no less than 44 per cent. of the total mortality falling within that period, and the months of November and December ranked first in point of unenviable precedence. Deaths were reported from all provinces in December—except the very small areas of Ajmer-Merwara and Coorg—and in numbers generally in excess of the normal prevalence at this time of the year. Only five districts out of 46 in Bengal and only two out of 11 in Assam were reported free of fatal cases in December; nearly one-third of the districts of the North-Western Provinces and Oudh and of Madras were infected, and serious outbreaks were reported in three of the districts of the Punjab; Bombay and the Central Provinces alone were comparatively free, though three districts in the former and two in the latter reported deaths in the last month of the year.

Deaths from Cholera in the different Provinces in India from 1877 *to* 1900.

Year.	Bengal.*	Assam.	N.-W. P. and Oudh.	Punjab.	Central Provinces.	Berar.	Rajputana.	Central India.	Bombay. §	Hyderabad.	Madras.	Mysore.	Coorg.	Lower Burma.	Upper Burma†	Ajmer-Merwara.
1877 ..	155,305	11,377	31,770	29	3,418	842	60	926	57,228	7,414	357,430	2,902	‡	7,276	—	11
1878 ..	95,192	6,732	22,221	215	40,985	34,306	2,393	8,047	46,743	6,696	47,167	723	49	6,759	—	210
1879 ..	130,363	17,415	35,892	26,135	27,575	223	918	2,734	6,937	6	13,296	14	—	1,828	—	120
1880 ..	39,643	2,803	71,546	274	330	1	—	299	684	—	613	25	—	2,638	—	3
1881 ..	79,180	5,010	25,885	5,207	9,140	3,404	197	581	16,694	1,721	9,446	25	3	5,239	—	16
1882 ..	182,352	21,055	89,372	39	11,932	3,573	1,327	1,562	7,904	150	23,804	893	31	7,177	—	289
1883 ..	90,439	14,908	18,160	190	16,235	27,897	797	1,740	37,954	1,947	36,284	124	—	2,185	—	87
1884 ..	134,421	22,276	30,143	614	149	87	1,297	1,018	13,804	2,479	75,476	330	—	5,515	—	227
1885 ..	173,767	7,753	63,457	1,936	21,868	3,683	1,615	4,624	37,287	1,387	58,109	2,677	—	7,685	—	100
1886 ..	118,368	20,188	34,565	12	16,679	976	173	290	167	499	12,417	10	—	4,027	—	765
1887 ..	172,578	7,941	200,628	8,804	12,576	14,396	2,612	8,868	25,711	2,831	28,359	832	3	2,649	—	364
1888 ..	111,391	9,693	18,704	14,938	921	305	32	191	36,500	2,057	58,677	1,015	2	15,982	—	13
1889 ..	171,103	18,288	48,494	2,838	52,588	10,925	6,923	3,344	32,431	1,128	76,020	1,590	9	3,240	—	55
1890 ..	145,885	15,396	80,295	3,401	4,787	847	2,746	3,132	3,259	—	35,288	1,326	5	1,076	—	408
1891 ..	129,575	23,882	169,013	10,107	21,312	7,958	2,946	13,474	17,850	3,102	98,773	1,204	7	2,400	—	532
1892 ..	259,398	21,552	194,886	75,959	39,972	2,030	26,760	8,384	42,900	53	79,033	5,497	56	6,208	—	2,352
1893 ..	126,976	21,849	12,154	639	557	1,188	314	127	18,853	165	32,209	680	9	2,393	—	3
1894 ..	236,150	13,497	178,079	113	7,043	3,452	2	5,210	33,588	1,862	42,289	328	8	7,428	—	—
1895 ..	177,087	18,962	51,562	549	15,508	11,919	1,049	6,043	8,890	467	21,172	2,334	—	5,150	—	289
1896 ..	226,824	17,042	69,147	5,146	52,985	12,264	3,797	15,766	35,404	525	47,847	2,100	49	2,959	—	4
1897 ..	196,247	33,240	44,208	622	57,131	10,122	1,496	13,202	57,109	1,039	143,445	4,248	106	8,538	—	19
1898 ..	65,020	11,149	2,508	§33	7	—	6	2	4,368	6	65,444	1,193	8	2,972	—	1
1899 ..	107,678	8,380	8,142	1,816	‖76	541	498	—	8,579	—	29,082	123	—	4,942	2,050	1
1900 ..	345,878	23,761	84,960	28,260	63,114	18,375	28,719	20,450	163,889	3,813	60,662	779	—	3,440	41	4,842

* Excluding Calcutta from 1877 to 1892.
† Statistics from 1877 to 1898 not available.
‡ Statistics not available.
§ Including 30 deaths in Cantonments.
‖ Excluding Zamindaries.

The *materies morbi* was, then, extraordinarily widespread at the commencement of the year under report, and it only required a continuation of favouring conditions of environment and a susceptible population to produce the results we have to deplore. And, so far as our present knowledge enables us to indicate and appraise the favouring conditions, they were abundantly forthcoming. It would be difficult, as of course it would be fallacious, to endeavour to summarise in a sentence the general meteorological features of the year over the vast area of this continent, but generally speaking it may be said that the monsoon ceased exceptionally early in 1899, and that the conditions thus produced were intensified by the comparative lightness or absence of the winter and spring rains and by the late onset of the great monsoon in 1900. Looking no further than to the effect thus produced on the drinking-water supplies, which for the enormous majority are drawn from superficial sources (rivers, open "tanks," and shallow wells, all within, or close to, crowded inhabited sites, and almost invariably subject to gross pollution), it is not difficult to follow the course of events produced by prolonged drought among a population as careless, ignorant, and fatalistic as that of India. The supply of one of the prime necessities of existence—and the most imperative—was cut off at innumerable habitual sources, causing an overwhelming call on those that remained which were for long months at their lowest ebb, and subject to all the deteriorating influences of stagnation, and to greatly enhanced risks of pollution. Add to this the widespread presence of the specific agent of the disease, and it is difficult to understand how any but the naturally immune escaped the penalty of infection. Briefly, the number of available sources of water-supply was enormously diminished, while those that remained were exposed to inevitable specific pollution, and radiated a far wider malign influence in proportion to the greater call made upon them. Scarcely any precautions would avail against such conditions; counsels of perfection are frequently a bitter mockery to those for whom they are proposed, and surely to the enormous mass of the famine-stricken and to the majority who were not far from famine, advice to boil their drinking water would have come with the force of the bitterest mockery.

The districts which were infected at the end of the previous year, and those which suffered most during 1899, were, generally speaking, those in which the disease first assumed epidemic force in 1900. Then month by month as the unfavourable conditions developed, as the drought became more intense and widespread, and as scarcity became famine over large tracts,* the mortality rose steadily or by bounds, the result being that although the prevalence of the disease varied considerably in different areas with the sum of the conditions that go to favour its propagation, yet it may be said that only nine districts within the bounds of British territory, from which alone approximately accurate records are received, were entirely free from fatal cases throughout the year.

This brief general survey may conclude with an allusion to cholera in Native States and in the neighbouring territories of Afghanistan and Baluchistan so far as the imperfect records available permit. In the twenty States included in Rajputana, where registration is very defective, 28,719 deaths were reported during the year, giving a ratio of mortality of 2·4 per 1,000 on the census population of 1891, and a ratio of 2·9 on the population of 1901. Famine was generally prevalent throughout this area, and the more or less aboriginal tribes (Bhils) suffered very severely.

In the States comprised in Central India, 18,545 deaths were reported, giving a death-rate of 1·8, but here as in Rajputana there can be no doubt that many deaths escaped record.

In the seven cantonment stations in the Hyderabad State from which reports were received, there were 3,813 deaths registered, which yield a ratio of 10·4 per 1,000 on the aggregate population. In all the above three areas the disease may be said to have first appeared in March or April and to have attained its greatest intensity in May, June, and July, with the culmination of the heat and drought, and to have died out in October after replenishment or reinforcement of the scanty water sources and the fall of the temperature.

In June the Government of India received intimation of an outbreak of cholera in the Khyber area of Afghanistan, and a little later, authentic reports of a widespread and virulent epidemic in other parts of the country, Kabul itself suffering severely. The disease appears to have disappeared in September, at any rate in its epidemic form, but no official record is available. The facts as to an epidemic in Baluchistan can merely be

* For a more extended reference to the effects of Scarcity and Famine, *see* Section on "Vital Statistics" and the account of cholera in the different Provinces which follows in the present section.

recorded in much the same terms ; the disease was believed to have been introduced by travellers from both India and Afghanistan ; the epidemic was at its worst during June and the three following months.

In August, cholera was reported to have broken out in Kashmir, and its introduction was traced, on reliable evidence, to importation from the Punjab, where the disease was, and had for months been, epidemic. The year closed with the disease still widely prevalent.

The foregoing details may afford a bird's-eye view of a historic epidemic ; we see cholera abnormally prevalent in the true endemic area of Lower Bengal and the Assam valleys at the end of the preceding year. There was in this area a comparative lull, but still widespread prevalence, during the early colder months of 1900, and then following the normal epidemiological course, there was a rapidly progressive rise to the highest development in the hottest and driest period preceding the monsoon, no marked depression occurring until the rains were well established. Beyond this area as we move westward the maximum prevalence is, as usual, found to be later and coincident with the first rainfall, the epidemic tide rising to its highest in the North-Western Provinces in June and in the Punjab in July, while at about the same time it pursues its ravages in the trans-frontier territories, and then flows into Kashmir.

The Madras epidemics pursue their normal characteristic course, subject to the influence of the two monsoons, a matter to which attention was directed in the last Annual Report.

General considerations on the subject of cholera and sanitation in India.—Before reviewing the most prominent features of cholera prevalence in the different provinces, it is impossible to refrain from a few remarks on the significance of the facts summarised. Taking the last four quinquennial periods, it cannot be said that any appreciable effect has been made upon the death-rate from this disease among the general population. While the mortality among British troops and the prisoners (with a daily average strength of 75,000 and of a little over 121,000 respectively) has been steadily reduced (and it must be borne in mind that among these classes registration of death-causes may be said to leave nothing to be desired), cholera comes and goes and leaves its mark upon the general population with a rhythmic intensity and lull that so far has defied our efforts to control it. It is late in the day to affirm that, in a true and broad sense it is "a filth disease," and that its prevalence connotes a failure to secure a certain standard of hygienic righteousness. While allowing for the special difficulty this country labours under from the fact that the causative flora find an indigenous habitat in many parts, the lesson of such epidemics as fall to be recorded here from year to year is plain, if the practical issue involved be one of enormous difficulty. It is true that to some extent the figures recorded have previously been so defective that the improvement which has recently been secured must lead to the impression of a larger comparative mortality. Any comparison with the past is subject to the gravest fallacy, but still it is certain that the figures as they stand are considerably short of the truth. Figures which run to millions are apt to be unduly staggering, and it may be urged that an all-round rate on the total population of less than 2 per 1,000 is a comparative trifle when set against a total death-rate of 30·5 (the mean for the five years ending in 1899 for all India, under registration). But it must be confessed that it has a far deeper significance for the sanitarian and the State. The conditions which favour cholera are similar to those which probably favour the whole class of bowel complaints, which doubtless claim something like one-third of the total harvest of death in India, though the imperfect records fail to exhibit them in this light. While laboratory research will doubtless elucidate many of the epidemiological problems, the cardinal principles of prevention were firmly established before the discovery of the true living agent, and we know that in Sir John Simon's words that this is a "disease against which there may be found security in the cultivation of public and private cleanliness ;" . . . "such cleanliness as consists in the perfect adaptation of drainage, water-supply, scavenage and ventilation to the purposes they should respectively fulfil," conditions which may, in this connexion, be summed up in the securing of a pure soil and pure water.

How do we stand in regard to this obligation ? The conditions under which the great bulk of the population lives makes the task of applying our knowledge of the etiology of these "filth diseases" one of extraordinary difficulty. Nine-tenths of the people live under conditions that do not permit of constant effective sanitary control by the comparatively small organization at our disposal. At the census of 1891 only some

27,000,000 souls (less than one-tenth of the whole) were to be found in towns containing a population of 3,000 and upwards, and the larger urban communities alone are subject to constant expert sanitary supervision though efforts have been made, in recent years, to reach the villages. Probably not more than an aggregate population of 5,241,265 enjoy the benefits of a properly conserved public water-supply, and certainly far less than that number avail themselves of it, and this fact at once brings to light the almost ineradicable prejudice for standing upon the ancient ways that has to be encountered in this question of cholera prevention, as, indeed, in every direction.* The result on the water-supply of a calamity such as a failure of the rains has been briefly touched upon. Then as regards pollution of the soil, the almost universally prevalent "trenching system," which probably has no rival when carried out with due regard to all the essential conditions, opens the way to very special and obvious dangers when it resolves itself into dumping filth anywhere and everywhere within and around inhabited sites and near water-sources, as is generally the case. Where adequate knowledge and control are available (as in the larger towns), the difficulties are often insuperable, while, where as in the case of village communities "trenching" might be carried out to the best advantage, the essential knowledge and control are, as a rule, wanting.

In face of these conditions and of the ignorance and apathy which beget them, it is incumbent upon Government to reorganize and extend the sanitary service, to bring it into closer touch with the scattered rural masses and to bring them education and assistance, while redoubling efforts in the larger centres. A scheme to this end doubtless presents difficulties; the "silent deep disdain" of an oriental people must be treated with consideration, and they cannot be dragooned into western methods in matters concerning their private life. There are also financial difficulties in a country which has recently passed through a series of crushing calamities from the failure of several harvests. But it is believed that these difficulties are not insuperable, and that Government is prepared to consider proposals which have been put forward for the reorganization and extension of the sanitary department, which it is hoped will mark a new era in the campaign against the more preventible causes of disease and death.

Bengal.—In Bengal, in 1900, the total number of deaths registered as due to cholera was 345,878 or 4·86 per 1,000 of the population, against 107,678, or a ratio of 1·51 per 1,000 in the previous year, and 65,030 (0·91 per 1,000) in 1898. Previous records of the disease in this its so-called "home" and endemic habitat, afford no parallel to the mortality of the year under review. The disease prevailed severely in every district, in no less than 35 out of the whole 46 the death-rate being in excess of 2 per 1,000; deaths were reported from 33,142 villages (about one-seventh of the total), while it assumed epidemic form in 228 registration circles, or in nearly one-third of the whole number, only 17 circles being exempt against 89 in 1899 and 130 in 1898.

The highest district death-rates were 23·77 in Purnea and 11·74 in Champaran; Cuttack, Palamau, Bhagalpur, Muzaffarpur, Shahabad and Dacca also suffered severely, the rates ranging from 8·48 to 7·1, while in 13 others the range was from 6·25 to 4·0 per 1,000. This exhibits the widespread nature of the epidemic in its most virulent form.

In 19 towns the death-rate ranged from 10·14 (in Kendrapara in Cuttack) to 30·42 (in Daltonganj in Palamau), and in 47 rural areas, from 10 per 1,000 in Madhuban in Champaran to 42·08 and 57·23 in two areas in the Purnea district. The urban mortality as a whole was at the rate of 5·06 per 1,000 against 4·85 in rural areas, where, however, registration is far less reliable.

Assam.—The number of deaths attributed to cholera in Assam was 23,761, a ratio per 1,000 of 4·51 on the census population of 1901. In the previous year 8,380 deaths were recorded, of which more than half occurred in the two last months. When the local distribution of the disease is examined, the fatal pre-eminence of the Brahmaputra Valley area, a constant feature of the reports, is at once apparent. The population of the Surma and Brahmaputra Valleys is approximately equal, but whereas in the former 6,791 deaths

* Take the metropolitan city of Calcutta for instance, which has a filtered water-supply. The Health Officer in his report for 1900-01 says:—"Mud is required for the coating of walls of huts" and for building purposes. "To provide this material holes have been dug in the soil with the result that every little collection of huts or houses contains one or more 'tanks' . . . used for bathing, washing clothes, and even for *drinking* and other domestic purposes. Nothing could be more filthy than the water of these tanks." And again; "in the central part of the town there are not many tanks left, but in all the suburban area the number is enormous. There are still a great number of wells in the town, and the water they yield is not safe to drink." Year by year a number of these tanks and wells are filled up, but the difficulties are very great, and, as the water-supply is not constant, it is not possible to insist on a general measure of filling up.

were reported, giving a ratio per 1,000 of 2·56 and registration is here at its best, in the latter there were no less than 16,970 deaths, or a ratio of 6·47 ; the records show that in only two years has this mortality been exceeded.

The disease fell with the severest force upon the three districts of Nowgong, Darrang and Kamrup, in which deaths were reported from all the registration circles and from about one-sixth of the total number of villages, the mortality giving death-rates of 24·95, 9·6 and 7·35 in the three districts, respectively. Nowgong is on the south bank of the Brahmaputra, adjoining Kamrup and facing Darrang ; it is notoriously the most unhealthy district in the Province. Cholera was present during the last months of 1899, and to about the same extent in January of the year under report ; there was a considerable increase in February and a sudden virulent outburst in March, maintained throughout April, during which two months 4,521 deaths out of the total of 6,529 occurred ; after June, the disease suddenly lost its epidemic character, but deaths continued to occur in each of the remaining months of the year. This is the sixth, and by far the most severe, epidemic from which this district has suffered during the last 12 years, there being an outbreak after a quiescent interval of two or three years in each case.

The particulars afforded of the epidemics in the neighbouring districts of Kamrup and Darrang in 1900 are stated in very similar terms, and the area may be considered one and practically undivided, for the river which courses through is rather a connecting link as regards the propagation of the disease. The Sanitary Commissioner confesses that he is "unable to say to what these repeated outbreaks can be due" * * "the habits of the people are as dirty and insanitary as possible ; they never change for the better, and they could hardly ever be worse." Here we have another endemic area, in an alluvial valley, from which the disease can never be said to be absent, though for considerable periods it assumes a more or less sporadic form. Then at short intervals the conditions become favourable for a wide extension, and we see the disease suddenly assuming a virulent epidemic force, indicating contamination of a common fomites, such as the water-supply, under certain climatological conditions. In this comparatively compact area with a population of a little over one million souls, no less than 10,221 deaths out of the total of 14,103 occurred in the March–June period just before the onset of the rains. Over 20,000 persons must have been attacked in this period, giving an *annual* morbidity-rate of about 50 per 1,000 ! Much as there is to learn as to the conditions of life of the germ in the environment, it is surely not difficult to understand how, given its presence therein, a people whose personal habits are so forcibly described in the words quoted and who depend on surface streams and collections of water, should pay the penalty in this deplorable way.

It is worthy of note that the death-rate among the immigrant coolies on tea gardens was considerably less than that furnished by the general indigenous population, which is quite contrary to the usual results recorded. There were about 662,471 coolies employed in 1900, and of these 2,085 died of cholera, giving a ratio per 1,000 of 3·15. The three districts which suffered severely are important centres of the tea industry, and a comparison of the death-rates suffered by the indigenous population and the garden coolies brings out the comparative immunity of the latter very strongly. In Nowgong, the general rate was 26·7, that furnished by the coolies was 2·3 only ; in Darrang, the rate excluding the gardens was 10·95, and in the gardens 5·17 ; in Kamrup, the rates were 7·37 and 3·99, respectively. Some part of this relative immunity may perhaps be fairly ascribed to the effect of inoculation with Haffkine's "vaccine," while for the rest, there is good reason to believe that the sanitation of tea gardens is receiving a larger measure of skilled attention, a matter for congratulation.

North-Western Provinces and Oudh.—The total number of deaths recorded from cholera in 1900 was 84,960 against 8,142 in 1899, the millesimal rates being 1·81 and 0·17, respectively ; the mortality has been exceeded on five occasions during the last 23 years, but while it is about 2½ times the average for the last quinquennium, it may be noted that the death-rate vies with those of the Punjab and Madras in being the lowest recorded in India Proper during this disastrous year.

In fourteen districts the number of deaths reported did not exceed 107 in any one, and in two others no deaths occurred, so that in about one-third of the Province the disease did not assume a serious form. The highest district death-rate was that furnished by Sultanpur (Oudh), *viz.*, 15·96 per 1,000, while among the towns, Ghazipur stands first with a rate of 4·82.

It is satisfactory to note that the Hardwar and Magh Mela (Allahabad) fairs again passed off without the appearance of epidemic disease, and this must undoubtedly be attributed, in a year like that under review, to the careful and systematic sanitary

measures carried out. Here, indeed, we have the other side of the picture to that touched upon in the remarks on page 89, and one that redeems the record of our efforts from the reproach of futility.

Punjab.—The year 1898 was one of almost total immunity from the disease in the Punjab ; in 1899, the deaths numbered 1,816, more than half of which occurred in two districts, where famine was prevalent. In 1900 the mortality figure rose to 28,260, giving a rate per 1,000 of 1·37, against a quinquennial mean of 0·08 ; indeed, in only one previous year, that of 1892 when the deaths amounted to 75,959, has this mortality been exceeded within the last generation. But there were very special factors in operation to produce this result, as will be seen when it is stated that, of the total number of deaths recorded (28,260) no less than 15,731 occurred in the famine districts of Hissar, Rohtak, Karnal, Ferozepore and Lahore ; in Hissar alone, where famine was at its worst, 6,399 deaths (or 23 per cent. of the whole) were reported, giving a death-rate of 8·25 per 1,000 of population.

With the exception of Hissar and Rohtak, the Province was entirely free from cholera for the first three months of the year. In the two districts named, the epidemic was a continuation of the outbreak of the previous year, and the disease was at first confined to the famine relief camps. It is most unusual for cholera to appear in the Punjab in the winter months, and much must be ascribed to the constitutional effects of famine and the aggregation of debilitated refugees. It is supposed that the source of infection was a tank, the water of which was drunk by these refugees ; the disease spread from camp to camp and subsequently to many towns and villages in the Hissar district. Thence the disease is stated to have been conveyed to a relief camp in the Rohtak district by famine labourers, and next it appeared in a relief camp in the Delhi district, among a gang of lower caste people (sweepers) who had been imported from Rohtak for duty. Next, in April, the disease broke out in Karnal, the first case being furnished by a pilgrim who had just returned from the Hardwar Fair. Thus the disease spread from place to place until in July, 26 of the 31 districts were infected and the epidemic was at its height, 9,711 deaths occurring in this one month, or one-third of the annual total. In August and September, though approximately the same area was affected, the mortality fell off greatly, and thenceforward the disease suddenly abated until in December only one district recorded deaths, *viz.*, Dera Ghazi Khan (17).

In the Punjab we find, as usual, the percentage of villages attacked very small compared with that in the endemic areas ; in Bengal it was 14·8, in Assam, 16·8, while in the Punjab, where famine prevailed widely and refugees were passing to and from nearly all parts of the Province and where also every district was infected, we get only 6·6 per cent. For one thing the water-supply which is largely from deep wells is naturally more easily conserved.

Central Provinces.—In 1898 there were only 7 deaths reported in this area, and in 1899 the number was only 76, a condition of immunity without a parallel in its annals. But in 1900 the mortality was the highest on record since 1869, 63,114 deaths being reported, giving a death-rate of 6·64 per 1,000 against a quinquennial average of 2·65.

The Central Provinces, as is well known, had passed through the ordeal of a very severe famine in 1897, but it is said by the Sanitary Commissioner that " the actual physical famine-producing conditions were much less severe in extent and degree in that year than in 1900." Here then we have again the key to the enormous mortality recorded from a disease which finds in famine its chief ally, and, unfortunately, it cannot be doubted that very many cases escaped registration.

It is said that the infection was introduced on one side into Chhattisgarh from Orissa (Bengal) and the Feudatory States, and into the west from Berar and Indore, and it must be remembered that all these areas were affected and that continuous to-and-fro tides of immi—and emigration were in progress throughout the year, the people seeking escape from both famine and pestilence and large numbers restlessly moving on from one centre of relief to another.

In January only one district was infected, and the same applies to February if we exclude the Mahanandi Zamindaries from which the records are inaccurate. In March the disease spread to the districts contiguous to the Zamindaries, and altogether the death-roll rose to 1,252 from 40 in the previous month ; In April only 8 districts were free, and 7,338 deaths were reported ; the number rose to 11,811 in May and to 20,158 in June, falling to 13,148 in July and to 7,893 in August. Thereafter the disease lost its epidemic character until in November it was practically extinct, no deaths being recorded in December. Its progress in the earlier part of the year " was accompanied by unusual

heat and dryness, for it was not until the second week in July that the monsoon was established"; thenceforth a rapid subsidence of the disease ensued. The Sanitary Commissioner reports that "the most strenuous efforts were made to combat the disease, and were most successful where the water-supply could be controlled; it is a fact worth recording that the disease never really gained a hold in the Public Works camps," though the figure he gives to support this view is open to criticism, possibly due to a clerical error. He goes on to say that during epidemics "all wells, small tanks and *jhiras* supplying drinking water to the affected localities, including famine-relief camps, were systematically disinfected with permanganate of potash, and it is reported that this was generally attended with good results." He furnishes various opinions by medical and civil officers in support of this view and in refutation of the recent tendency to question the value of such "disinfection." It is to be hoped that more definite and reliable facts may in future be obtained as regards the practical utility of permanganate in this connexion, based on simple records maintained at the time, and which it is proposed to issue on a uniform plan.

It remains to add that no less than 8 towns had a recorded mortality from this cause of over 20 per 1,000, the highest rate (37·7) being that returned from a small town in the Sambalpur district. No less than 21·3 per cent. of all the villages were attacked, the disease was therefore widespread, and no object would be served in indicating here the special incidence in different districts.

Berar.—The Hyderabad Assigned Districts have physically many features in common with the Central Provinces, and in 1900 a disastrous famine prevailed; in 1898 the area was entirely free from cholera; in 1899 only 541 deaths were reported, but in the year under review a severe epidemic claimed 18,375 victims, a death-rate of 6·4 per 1,000, which has, however, probably been exceeded on three previous occasions, *viz.*, in 1875, 1878 and 1883. In three of the six districts the disease was present during the last quarter of 1899; it appeared in a fourth district in January, in a fifth in March, and in April all districts were affected. It rapidly assumed epidemic proportions during the hot, dry period, and culminated in July, when 6,452 deaths were reported; the number fell to 2,498 in August, after which the disease died out as rapidly as it had advanced. Registration is perhaps as complete and accurate in Berar as in any area in India, and it is therefore noteworthy that the Sanitary Commissioner believes that "over 10,000 deaths from cholera were erroneously registered under other heads through ignorance, superstition or laziness;" possibly then the aggregate mortality numbered 30,000. It was impossible to trace the source of importation—if indeed we need to assume importation—as famine-stricken refugees from the Hyderabad State and from Bombay had wandered into Akola and Buldana. But, as already stated, the disease was present, many of the water-supply sources dried up and left the rest concentrated and subject to pollution; in addition to this famine stalked through the land. Whenever cholera was reported from a village a hospital assistant or a vaccinator was deputed to "disinfect" all water-supply sources, "and four or five days after this, the epidemic in almost every case ceased. This procedure answered admirably," says the Sanitary Commissioner, "during the cold and hot weather months. When, however, the rains set in it was found impossible to 'disinfect' all available sources, and the villagers helped themselves to any pool or puddle they came across, and these very soon became infected and spread the disease." Still it is noteworthy that cholera rapidly disappeared with a full replenishment of the water sources. In the Basim district, where famine was at its worst and where the total death-rate amounted to 110·8 per 1,000, cholera claimed about one-third of the victims that succumbed to this disease, the rate recorded here being 15·0 per 1,000 from this one cause. All over Berar 18·2 per cent. of the villages were attacked.

Madras.—The total mortality from cholera in 1900 amounted to 60,662 cases, or 1·8 per 1,000 of population (which is about the quinquennial average), against 29,082 cases, or 0·9 per 1,000, in the previous year, which was one of the lowest incidence on record.

The districts of Madura, Tanjore, Tinnevelly and Godavari suffered most, the death-rates therein having ranged from 4·7 to 3·0 per 1,000; all the 22 districts were more or less affected, though two (Nilgiris and South Canara) had only two cases each.

As previously pointed out, the incidence of mortality was heaviest in the districts affected by the south-west monsoon in July, August and September, and in those under the influence of the north-east monsoon in October, November and December. From 49 out of the 61 municipal towns, 5,789 deaths (equal to 2·7 per 1,000 of the total urban population) were reported; Periyakulam with 20 per 1,000, followed by Tinnevelly with 13·8 and Palni with 12·4 being highest; the rate in rural areas averaged 1·8.

Coorg.—As was the case in the previous year, no death from cholera was recorded in this small province during 1900.

Bombay.—The terrible experiences through which the Bombay Presidency passed in 1900, have already been faintly indicated; cholera vied with famine in their devastations, and plague has now become an only too familiar feature in the death statistics. In 1899 only 8,579 deaths were reported from the first-named disease, but the number rose in 1900 to the appalling figure of 163,889, yielding a death-rate per mille of 8·71, by far the highest for any province in India, and nearly five times that of the quinquennial average. The number recorded is fully one-eighth of the total mortality (all causes) for the Presidency, and there is ample evidence that very many deaths from this cause escaped registration.

Every district was affected, though the collectorate of Kanara escaped with only 82 deaths; but the epidemic fell with exceptional virulence upon the Gujarat and Western Registration districts where, excluding the City of Bombay (5·27), the death-rates ranged from 10 to 22 per 1,000 of population. In December, 1899, the disease was present in the collectorates of Dharwar and Bijapur and in the City of Bombay, and in January we find the same areas affected with Khandesh in addition. In February and March, beyond a rapid extension in Khandesh, matters were in about the same state till in April the disease had spread to fourteen districts yielding 15,086 deaths. In May the mortality rose to 32,929, and in June to 33,625, Sind having now become infected, and in July, with an aggregate death total of 44,521, the epidemic reached its culminating point, the monsoon rains having been very light and partial until the end of this month. With the second onset of the monsoon and during August and September, though all districts were affected, the mortality fell off markedly, the former month yielding 23,123 deaths, and the latter only 4,924, the subsidence continuing until in December there were only 488 recorded, and these from nine districts, the Gujarat area having been practically free from October.

For the most part the epidemic fell with the greatest force upon the famine-stricken areas, and on those centres to which the necessitous refugees flocked. Out of 220 rural circles, 201 were more or less severely affected, and in 58 the death-rate exceeded 12 per 1,000, the highest rate recorded (in Vada in the Thana District) being 39·67. Of 56 town circles 51 were attacked, and 29 of these recorded rates of 10·47 and upwards, 12 being in the Gujarat Registration district. The town of Borsad (population 12,159) in the Kaira collectorate suffered the appalling death-rate of 126·9 per 1,000 of its population.

The affected area included 8,461 out of the 25,143 villages in the Presidency (33·8 per cent.), but in Karachi district the percentage affected was as high as 87·7; in Hyderabad it was 66·9; in Kaira, 50·7; in Broach, 50·1; in Thana, 47·9; in Surat, 43·5; and in Satara, 42·5.

The officers of the sanitary department record similar impressions as to the causes that led to this deplorable mortality; they refer to scanty and polluted water-sources, to insufficient and unsuitable food ("badly cooked or raw grain, wild seeds, leaves, bark of trees, roots, &c.," and, in some cases, the flesh of animals that had died of disease), and to the fact that crowds of beggars and wanderers left their homes to seek relief in the larger villages and towns, thus disseminating the disease and its readiest victims broadcast. Again, when the disease broke out on relief works or in camps, a stampede frequently followed which it was impossible to control. Nothing, surely, is wanting to such a picture of accumulated horrors, or to account for the results.

Burma.—There were altogether 3,481 deaths from cholera recorded in Burma during 1900, of which 41 only were reported from the Upper province; the death-rate per 1,000 in Lower Burma, 0·77, is below the quinquennial mean (1·09). The highest mortality was returned by the Thongwa, Mergui and Myaungmya districts, with 2·75, 2·38 and 2·28 per 1,000, respectively. The urban rate exceeded the rural, as is usual, owing partly to density of population and partly to better registration. Sixteen of the 34 town circles and 6 per cent. of the villages suffered. "Civil Surgeons submitted detailed reports of the outbreaks in their districts, but these reports bring nothing new to light as regards the origin or spread of the disease, and it would serve no useful purpose to review them here. An impure or infected water-supply was generally associated with these outbreaks," and the seasonal incidence was chiefly upon the hotter, drier months, ending with the onset of the monsoon.

Cholera among the Troops and Prisoners.—This year (1901) it has been decided that no detailed summary of the "cholera registers" should be given in this place, though the facts disclosed have been used for instruction and the promotion of remedial action where such has been indicated. No fresh light has been thrown upon the etiology of the infection, though the lessons to be derived from the facts summarised in this section from year

to year have been confirmed. The Government of India has recently issued orders for the discontinuation of the "cholera register" which the medical officer concerned has hitherto submitted. This is one of the results of the deliberations of a committee entrusted with the task of examining the value of the numerous returns and reports furnished on all matters concerning the health and the economy of the army in India. This, of course, does not imply the abolition of records of cholera outbreaks in future, but these will take a different form, and it is the intention to revise and codify the general lines on which a single cholera report for each outbreak is to be drawn up in future, while it is hoped to direct attention to all the more important questions of the etiology of the disease. It is confidently anticipated that with the facilities provided by the new command laboratories, more exact and scientific data will take the place of vague guesses and opinions on this subject, and that, starting from the broad general conclusions established, a new departure based on more exact methods of research will be made. At this point, then, the broad facts and the incidence of the disease on the troops and prisoners will be briefly stated, concluding with a short summary of the main indications they afford.

Cholera among British Troops.—In last year's report only one fatal case of cholera fell to be recorded for the year 1899 in the whole European Army in India. It could not be expected that such phenominal immunity should be maintained during 1900, when the disease was almost everywhere at its maximum epidemic prevalence, and when, consequently, the troops were surrounded by foci of infection. Under these circumstances it is matter for some satisfaction that the total number of cases recorded among all ranks of the European troops was 107 with 88 deaths, a case mortality of 82·2 per cent., while among all classes of followers there were 101 cases and 68 deaths, or, altogether, 208 cases and 156 deaths. These were reported from 28 communities (station hospitals, regiments, and batteries) in 28 different stations. The death-rate on the aggregate average strength of the troops (excluding followers) was therefore only 1·45 per 1,000 against 3·70 per 1,000 for the general population, and as we have seen the latter must be accounted short of the truth owing to defectiveness of registration. In many stations where cholera prevailed in the surrounding communities no case was recorded among the European troops or followers.

Cholera among Native Troops.—The returns show that 112 bodies of men located in 76 separate cantonments or camps were attacked during the year 1900. There were altogether 641 cases, of which 390 proved fatal among the rank and file of the native army, while among the followers, &c., there were 409 cases and 212 deaths: that is to say, altogether 1,050 cases and 602 deaths. Calculating the total mortality on the aggregate average strength, the death-rate among the troops (excluding followers) was 3·16 per 1,000, against 3·70 per 1,000 for the general population. In many stations contiguous to or surrounded by communities in which the disease was present among the general population no case occurred among the troops or followers.

Of the total number of cases and deaths recorded it may be noted that not far short of one-half occurred in the Punjab, and fully one-third of the whole in the North-west Frontier stations and outposts. In Kohat alone there were 314 cases with 151 fatalities, to which five regiments, one infantry depôt and two mountain batteries contributed.

*Cholera in the jails.**—Among the jail population with an aggregate strength of 116,408 there were 515 cases of cholera, of which 286 terminated fatally, giving a death-rate of 2·5 per 1,000 of population against 3·7, the rate for all India under registration. In all, 70 different jails were affected, of which six were in Burma (34 cases and 21 deaths); one in Assam (one fatal case); twenty-seven in Bengal (191 cases and 101 deaths); six in the North-Western Provinces and Oudh (14 cases and eight deaths); five in the Punjab (35 cases and 14 deaths); seven in the Bombay Presidency (128 cases and 67 deaths); two in Berar (14 cases and 11 deaths); nine in the Central Provinces (63 cases, 43 deaths); six in Madras (33 cases, 20 deaths); and the Ajmer Jail, in Rajputana, which reported two non-fatal cases. If the death-rates afforded by these fatalities, calculated on the annual average strength of each provincial group, be compared with those of the general population of the province in each case, it will be found that in only two cases did the jail rate exceed that of the province; *e.g.*, in Burma the jail rate was 1·7 per 1,000 against the provincial rate of 0·77, and in the Central Provinces the rates were 7·6 and 6·64 respectively; in Bengal they were approximately equal. But it has to

* The figures differ from those in the statement on page 65, as in the former data are given for subsidiary as well as for central and district jails and for *all* the cases of cholera that occurred.

be remembered that while the jail rate is absolutely accurate, that recorded for the general population is subject to a grave error of defectiveness. In Assam the jail rate was less than one-sixth of that of the Province ; in the North-Western Provinces only about one-ninth ; in the Punjab a little more than half ; and in Bombay Presidency about one-half of the general provincial rate. When the fact that the disease was present in every district, and when the disadvantages incurred by an aggregation of individuals in jails are considered, and, in addition, the low standard of physique and resistance of the criminal population, the results may fairly be deemed satisfactory and to represent the results of the care bestowed on all matters of hygiene.

Summary of alleged causes.—Still, when we come to investigate the evidence afforded as to the causes to which outbreaks among the troops and prisoners were attributed, there are admittedly facts which indicate that in some cases much remains to be done in this respect. In last year's report the state of the drainage of the Mian Mir cantonment was referred to, and this is again the subject of animadversion ; but what is perhaps of far more urgent importance is the necessity of extending the pipe-water supply to the native lines in this station. The danger arising from the open irrigation channels in Kohat has been alluded to ; these are examples of a small minority of cases where reform is urgently called for.

For the rest we have the universal prevalence of the disease in its worst form, and nearly every community was situated in a centre of contagion. In the majority of cases the outbreak was traced to polluted water obtained outside the regular supply provided, in villages, bazaars, and elsewhere when the men were "out of bounds." In a few cases attacks were attributed to a too liberal diet of raw fruit and vegetables or to milk obtained as a rule from places known to be infected ; the carriage by flies of the virus into the institution attacked is suggested in no less than five cases as the most feasible hypothesis.

In the great majority of instances the first cases had had direct personal communication with an infected environment ; among European troops the first attacked were those who had been "out of bounds" ; among native troops sepoys returning from leave and travelling through an infected area, and among prisoners, admissions from infected areas, and first attacks among those on duty outside the jail, introduced the infection as a rule.

The one other established fact as to which the records leave no doubt is the efficacy of movements from the infected site ; in the majority of cases this measure was adopted with almost immediate and conclusive results.

Lastly, it may be noted that of the total number of attendants on the sick, among troops, followers, and prisoners, only 49 persons in all were attacked with the disease, a ratio of 1·7 per cent.

Anti-cholera inoculation.—In the year 1899 the total number of operations performed at the Purulia depôt in Bengal, the only place where inoculation is systematically carried out, was 2,388 ; in 1900 the number rose to 13,291, and the subjects were all emigrants proceeding to the labour districts of Assam and Cachar.

It is, to say the least, unfortunate that the duty of furnishing returns of cholera cases and deaths is not made incumbent upon the employers of these labourers ; it is now permitted to be optional, and returns were received from only five gardens. This is a matter to which attention will be directed, as it is obviously desirable from every point of view that the results of inoculation should be ascertained with some approach to accuracy, and that its efficacy be established or refuted. The only material available for the year under review as a contribution to this question is the record furnished from Goalundo. Of 1,527 uninoculated coolies who passed through Goalundo from April to June, 32 or 2·09 per cent. were attacked by cholera, of whom 17 died ; while among 873 who had been inoculated there were only two cases (0·22 per cent.), both, however, fatal.

A study of the effects of inoculation.—A most interesting series of observations made by Captain Lamb, I.M.S., of the Bombay Research Laboratory, and Major Buchanan, I.M.S., on the effects of inoculation on a large number of prisoners in Nagpur Jail will shortly be published in a forthcoming issue of the Scientific Memoirs (new series) by officers of the Medical and Sanitary Departments of the Government of India, but the results may briefly be summarised in this place :—

(*a*) A preliminary injection of a dead "vaccine" a few days before the living material is inoculated has the effect of causing the constitutional disturbance which follows the latter inoculation to be more severe than when no such preliminary injection is employed. The larger the dose of dead material the greater is the reaction following the injection of the living vaccine.

(*b*) Women exhibit a greater constitutional reaction than men.

(*c*) A slight increase in the amount of living material used causes a great increase in the severity of the constitutional reaction.

(*d*) A previous attack of cholera, recovered from a fortnight to a month previously, has the effect of decidedly lessening the constitutional reaction following a dose of living cholera "vaccine."

(*e*) Finally, an endeavour was made to appraise the effect which these inoculations had on the weight of the inoculated when compared with the ordinary fluctuations in the weight of the uninoculated, and the figures presented show that no appreciable difference in this respect can be demonstrated between the two classes.

Small-pox.

The mortality ratio of India from small-pox rose in 1900 by 75 per cent., but was slightly lower than the quinquennial ratio. All the months of the year, but especially the earlier, showed a greater number of deaths. The total number of deaths in the preceding year had been 53,347. In Lower Burma the epidemic which started in 1898 is now abating. Thirteen cases were detected in the Port of Rangoon—the number of deaths is not stated. In the rural areas of Upper Burma compulsory powers are wanting for the protection of the people, and the law, as it stands, has no authority to prevent the inoculator disseminating the disease, and keeping up a source of contagion which infects the towns by importation. It is believed that small-pox is in a fair way of being eradicated from Assam. The Bengal mortality from small-pox was, as usual, highest in Orissa, Cuttack alone returning more than one-third of the total deaths recorded under this head in the whole province ; and this severe local prevalence of the disease is said to be attributable to the aversion of the people from vaccination and their preference for inoculation. Only three cases, of which one proved fatal, were detected by the Port Health Officer of Calcutta. That the urban mortality was greater than the rural is an unusual feature of 1900 in Bengal; but all the other provinces, except Burma, Madras, and Mysore show the same. The ratio of the North-Western Provinces and Oudh is the lowest on record, and no district, except Aligarh, had more than 100 deaths. Into the Central Provinces the disease made its entry from the Bombay side, and invaded every district but one. The Sanitary Commissioner was able to secure the vaccination of no less than 28,160 children among the large numbers collected in the famine relief camps. In Berar the badly vaccinated district of Wun suffered most. The Sanitary Commissioner of Madras insists that until vaccination is made compulsory in rural areas, more satisfactory results cannot be hoped for. Although vaccination is appreciated by the bulk of the population, mothers are still reluctant to submit their children to the operation ; and the people are often unwilling to undergo it while the disease is present in their midst. The mortality in Bombay was the highest recorded for the past ten years. No district was free, though some were visited lightly. Both in the City of Bombay and in the districts adjacent the outbreak was much increased by the large influx of strangers. In the City of Bombay over 34,800 vaccinations and revaccinations were performed. With regard to Gujarat it is said that, considering the enormous influx of people from surrounding states during the famine, the number of deaths was not large, which testifies to the good work done by the vaccination staff. As to the Port of Bombay, it is stated that there were 1,392 cases of small-pox, against two in the previous year, detected at the outward and inward inspections and on board the vessels lying in the harbour. The number of deaths is not stated.

Statement showing the deaths from Small-pox registered in the different Provinces by Months during the year 1900.

Provinces.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Ratio of deaths per 1,000 of population	
													1900.	1900.	1899.
Bengal	1,705	1,625	1,972	2,874	2,777	2,181	2,061	1,137	793	808	783	1,844	20,620	0·29	0·18
Assam	44	47	82	58	123	116	67	53	83	31	91	180	975	0·18	0·31
North-Western Provinces and Oudh.	58	79	149	225	257	241	131	89	38	47	25	71	1,410	0·03	0·04
Punjab	852	611	847	1,350	1,651	1,466	1,312	768	529	309	318	512	10,425	0·51	0·25
Central Provinces*	354	485	903	1,075	905	814	616	436	387	372	223	435	7,005	0·74	0·11
Berar	89	109	141	172	128	87	61	21	10	1	—	11	830	0·29	0·11
Lower Burma	272	316	508	529	413	352	244	110	48	54	87	81	3,014	0·68	1·32
Upper „	130	241	486	651	497	325	160	85	61	19	71	63	2,789	1·14	0·50
Madras Presidency	2,702	2,550	3,025	2,761	2,246	1,902	2,204	2,327	1,892	1,865	1,738	2,400	27,602	0·84	0·51
Bombay „	1,366	1,451	2,070	1,566	988	622	374	202	134	107	201	404	9,385	0·52	0·10
Ajmer-Merwara	628	569	697	464	192	42	15	3	—	—	—	—	2,610	4·81	1·77
Coorg	6	8	17	14	23	22	22	18	26	44	45	69	314	1·81	0·16
Mysore	373	416	383	395	330	418	462	284	238	270	355	362	4,286	0·88	0·62
Total	8,539	8,007	11,280	12,024	10,530	8,678	7,729	5,533	4,239	3,927	3,937	6,432	91,855	0·42	0·24

* Excluding Zamindaries.

Plague.

For India as a whole there was a decided decrease in plague mortality. The decrease took place principally in Bombay, Madras, and Hyderabad State; while the greatest increase was in Bengal. Assam and Coorg remained unaffected, and Central India recorded no mortality.

The main points of interest with regard to plague have been dealt with so fully in Chapter III. of the Report of the Indian Plague Commission, that it is not necessary to touch upon them here, but the following are a few jottings :—

Sputum. Persistence of the bacillus.—Gottschlich in Egypt found virulent bacilli up to the 76th day in the sputum of a man who had recovered from plague; in dried sputum the bacillus was still virulent for a month; in the peritoneal exudation of guinea-pigs for three weeks; in dried-up urine only for three days, because urine dries very thoroughly; in old agar cultures for 8½ months; in the buboes of corpses for 12–16 hours; in the buried bodies of guinea-pigs for three, but not five, days; in the organs of dead animals for 24 hours, but not for two days; in the sputum of a pneumonic-plague patient kept in a covered spittoon in darkness at 25 deg. to 28 deg. C. for four to ten days. On the other hand, Métin's experience was that the sputum was innocuous when ten days had elapsed from the complete fall of the fever and the disappearance of stethoscopic signs; while Schottelius states that when the bacilli become generalized (septicaemia) they may be found in the sputum even of non-pneumonic cases. Rosenau in America kept the bacillus alive for 75 days in the dry state, but confesses that complete dessication was not attained; and Schultz states that when kept cool and sheltered from light, it can preserve its life and virulence for four years. Rosenau's experiments are said by him to show that the plague bacillus is not a frail organism, that temperature is the most important factor in its viability, that moisture favours its life, that sunlight kills it in a few hours, that its virulence is often lost before its vegetability, that clothing, bedding, and food products may carry the infection, that the organism may live a long time in water, &c.; and Sata reports that in dead bodies and earth most of the bacilli perish, but that those which survive become gradually more virulent.

Rats and other animals. Insects. Mode of entrance.—From Robertson at the Cape comes the statement that plague occurred and the specific bacillus was found in cats, rats, a ferret, a guinea-pig, a mouse; and that care has to be exercised not to take the bacillus of chicken cholera for that of plague. Thomson in Australia found the bacillus in rats, in a cat, and in a flea from a rat sick of plague. Opinions as to the part which the rat plays vary from that held by Davies that plague is primarily an epizootic disease communicable to man rather than an epidemic disease communicable to animals, to that of Abel who believes that man is the most dangerous spreader of the disease, and points out, as the result of a study of the old literature, that past European epidemics appear to have run their course without any important participation of rats and mice. In this connexion it may be interesting to note that Kitasato and others reporting on the plague in the Japanese towns of Kobe and Osaka, record that out of 291 dead rats examined in the former the plague bacillus was found in only 61, and out of 200 in the latter in only 23. The Australian reports of Ashburton Thompson and others are strongly in favour of rat agency. But, granted that plague-infected rats are dangerous to man, it is difficult to understand how the infection is conveyed. As Ashburton Thompson says, if the rat is required to explain the local diffusion of the disease, another intermediary, the flea, is required to explain the conveyance of the infection from rat to man. This supposed rôle of the insect, first suggested by Simond, appears, especially at the present time, so natural and likely that it is accepted as true by many, including Thompson, Manson, and Klein. On the contrary, Nuttall, Kolle, Galli-Valerio, and others have failed to verify by experiment any such transference of infection; and if it be a reality, there must be some necessary condition in natural infection which has not yet been fulfilled in the laboratory experiments. Kolle has been so impressed with Ashburton Thompson's evidence that he proposes to renew his experimental investigation. Thompson himself in the few experiments he was able to make did not succeed in conveying the infection from rat to rat by means of fleas. In one case he found the plague bacillus in a flea from a living sick rat from an infected house. In the case of 2 out of 9 rats brought in, the flea found on them was *P. serraticeps* (the ordinary dog and cat flea), and in 7 *P. fasciatus*. Manson is reported as having stated, on what authority is not clear, that the fleas of the rat, like those of dogs and fowls, will attack man if driven from their own host. The weak points of the following fresh case of infection supposed to be due to rat-handling are,

that no evidence is offered that there were fleas on the rat or that the rat had died of plague, and that the incubation time seems too short, though the situation of the bubo minimizes this second objection. A daughter of the native head warder of the Yerrowda Reformatory (Poona) died of plague on the 9th October. The family, after segregation, returned to the quarters on the 20th, these having been disinfected and whitewashed. Their second child found a rat dead on the evening of the 22nd, carried it for a minute or two in her right hand, and then threw it away. She developed plague on the 23rd, and died on the 29th, the bubo being in the right axilla. Holub has been experimenting successfully on the use of living insects as a culture medium, but so far he has only used the microbe of soft chancre. The continued experiments in Europe and India (Hankin) on the use of Danysz' bacillus for the extermination of rats do not promise the probability of practical usefulness on the large scale. Bronstein claims to have been more successful than his predecessors through the use of alkalinized feeding media, but, though this may secure a larger number of initial infections, it does not make any more certain the desired subsequent spread from animal to animal. The old idea that the ground being defiled with the excrement of plague-sick rats or with the excretions of plague-sick men, the virus enters through abrasions of the bare feet of the habitually unshod natives, and so produces a relative frequency of femoral and inguinal buboes, receives much acceptance still both among Indian medical men and among foreign savants visiting Bombay for purposes of investigation. But in Sydney 73 per cent. of the buboes were in the groin, and, as Ashburton Thompson says, "the inhabitants of Sydney no more go barefoot than do the inhabitants of London"; and this only confirms what was observed in the case of British soldiers at Hongkong. Simond has shown how the frequency of buboes in that region can be reconciled with the flea hypothesis. But in any case it is evident that the barefoot hypothesis can no longer be supported by the fact of the relative frequency of buboes so situated. Kolle, and also Kossel and Overbeck, have confirmed the observations of the Austrian Plague Commission as to the ease with which certain animals can be infected by gentle friction of the uninjured skin. Several cases of infection through injuries have been reported.

Incubation. Serum reaction. Countries affected.—An Arab deadhouse servant observed by Gottschlich injured his left little finger on the 29th May, and on the 3rd June a plague bubo was found in the left axilla. On October 8th, 1900, a warder at the Brisbane General Hospital assisted at two plague post-mortems, on the morning of the 11th he was ill, and on the 12th it was proved by clinical and bacteriological examination that he was suffering from plague. Dr. Hutchins, who reports the case, does not say that the man wounded himself. Klein and Markl both report favourably on the diagnostic value of the serum test.

Statement showing the deaths from Plague Registered in the different Provinces by Months during the year 1900.

Province or State.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total. 1900.	Total. 1899.
Bengal	2,046	5,813	13,050	6,246	1,432	522	330	344	295	793	2,264	5,277	38,412	3,264
Assam	—	—	—	—	—	—	—	—	—	—	—	—	—	—
North-Western Provinces and Oudh.	16	23	78	16	—	—	—	—	1	—	—	1	135	7
Punjab	44	77	148	125	77	4	—	—	—	—	49	48	572	255
Punjab Native States (Patiala).	—	—	18	1	—	—	—	—	—	—	—	—	19	—
Central Provinces ..	206	201	117	41	21	—	1	—	1	2	—	—	590	584
Berar	1	—	—	—	—	—	—	—	—	—	—	1	2	2
Burma	1	—	1	—	—	1	—	—	—	—	—	—	3	2
Madras Presidency ...	250	155	82	11	11	9	3	22	21	39	29	32	664	1,658
Bombay „ ...	3,695	3,659	4,631	4,491	1,877	521	352	824	3,651	5,345	2,544	1,606	33,196	96,596
Bombay Native States	554	345	855	1,581	484	46	7	65	294	374	324	243	5,172	19,427
Baluchistan	—	—	—	—	—	—	—	—	—	—	—	—	*2	—
Ajmer-Merwara ...	1	1	—	—	—	—	—	—	—	—	—	—	2	1
Rajputana	3	4	1	2	—	—	—	—	—	—	—	—	10	23
Central India	—	—	—	—	—	—	—	—	—	—	—	—	—	2
Coorg	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mysore	592	337	180	66	29	30	134	813	2,146	3,462	3,381	2,205	13,375	10,810
Hyderabad State ...	280	101	129	31	33	4	8	4	2	10	30	21	653	6,378
Total ...	7,689	10,716	19,290	12,611	3,964	1,137	835	2,072	6,411	10,025	8,621	9,434	92,807	139,009
Calcutta City	263	799	3,326	1,935	684	366	248	261	184	85	32	95	8,278	2,681
Bombay „	1,718	2,491	3,125	2,367	1,141	421	268	270	357	380	283	464	13,285	15,874
Madras „	—	—	—	—	—	—	—	—	—	3	1	—	4	—

* The dates of the deaths are not given.

Plague in the Bombay Presidency.—The incidence of plague was very much less in 1900 than in the two previous years. In every circle, except Kurrachee, the attacks and deaths were very much lower than in the previous year. Whether this was due to the waning of the disease, to the less severe measures, to inoculation, to non-registration of plague deaths, or to the numbers of those liable to plague having been reduced by causes such as famine, the Sanitary Commissioner leaves to the future to decide. In the whole Presidency there were 43,064 attacks and 33,196 deaths, or, excluding the city of Bombay, 25,151 attacks and 19,911 deaths; and 587 towns and villages were affected. In 1899 the whole Presidency had had 126,287 attacks and 96,596 deaths, and 2,256 towns and villages affected. The epidemic continued throughout the year, was at its lowest intensity in July, and reached its maximum in October. The districts of Broach, Panch Mahals, Thar and Parkar, Shikarpur, and Jacobabad remained uninfected throughout the year. Most deaths occurred in the city of Bombay, and in the collectorates of Poona, Belgam, Kurrachee, Thana, and Dharwar; and the highest death rates in the city of Bombay, and in the collectorates of Poona, Belgam, Kurrachee, and then Thana, Nasik, Dharwar, and Sholapur. In the Poona collectorate plague occurred in all the talukas, except Junnar: 86 towns and villages were affected, and there were 6,086 atttacks and 5,086 deaths reported. Only in June was the collectorate free from the disease. There was a large and sudden increase in the mortality in August, and the maximum was reached in October. In the Belgam district, as in 1899, the disease was present during the entire year. The maximum was reached in October. Ninety-three towns and villages were affected, and 6,498 attacks and 4,647 deaths were reported. The increase which took place in the Kurrachee district towards the close of 1899, continued in the first months of 1900, and reached its maximum in April. The disease ceased in June, and the district was then free till the close of the year. In the whole collectorate 16 towns and villages were affected, and 3,164 attacks and 2,446 deaths were reported. The Kurrachee town circle suffered most. Thana district was affected during the whole year, as in 1889. The plague in 51 towns and villages amounted to 2,402 attacks and 2,046 deaths. The maximum was reached in April and there was a secondary increase in August and September.

Plague in the City and Port of Bombay.—As in 1899, plague was prevalent in the city of Bombay throughout the year. The Municipal Commissioner, writing of the period ending 31st May, 1900, says that experience has thrown no new light upon the ways of plague. He quotes various district officers to the effect that the disease is one of localities rather than of particular classes of people; that it appeared to be more localized than in previous years; that the disease sticks to certain buildings with great persistency; that instances occurred where attention to sanitation appeared to confer immunity; that as a rule once a house has been thoroughly disinfected, plague does not visit it again that year, though it is almost certain to do so during the next epidemic. During the year 59 persons affected with plague were not permitted to sail on outgoing vessels; 14 persons on inspection were found to be plague-stricken on vessels and native craft in the harbour, docks, and bandars; and 11 cases occurred in vessels on or before arrival at Bombay from other infected ports, making a total of 84 plague cases in connexion with the harbour. The falling off in the number of cases detected was due to the fact that most of the rejections during 1900 were turned into the town, whereas in previous years they had been kept under observation for some time in a camp. In no instance could plague, breaking out at foreign ports, be traced to the crew or passengers on vessels from Bombay. The known rigorous nature of the examination prevents persons likely to be rejected from presenting themselves.

Plague in Bengal.—The Rajshahi and Chittagong Divisions were entirely, the Dacca, Orissa, and Chutia Nagpur Divisions almost entirely, free from plague, which was severest in Calcutta, Patna, Saran, and Monghyr almost throughout the year, and in Gaya during October to December. The total number of seizures was 40,294, and of deaths 38,412. A feature of the disease, noticed by the Sanitary Commissioner in all places where it prevailed, was that it continued with intense virulence throughout the winter, culminating in March; and that it practically disappeared or remained dormant throughout the hot and rainy seasons, to recrudesce early in October with the advent of the winter. The attitude of the people was always troublesome at first; but after they had been taught by the hard facts of experience, they learned to accept, or even to welcome, the measures instituted for their good. Disinfection of huts, houses, and clothing was largely resorted to in plague-infected areas. As a rule, the result of evacuation, which was sometimes voluntary, was satisfactory; but in some cases the villages were unfortunately reinfected

by the too early return of the villagers, or by the admission of people from other infected villages. The people, however, are said to be learning to guard themselves against these dangers. The district of Patna, which was infected from Calcutta, suffered more than any other, and especially the towns of Patna, Dinapore, Barh, Bihor, and Mokameh. As each village became affected, it acted as a centre for disseminating the disease to its immediate neighbours. Villages situated near main roads were always more likely to be infected early than those more remotely situated ; and in the latter class of villages the disease was nearly always spread by the better class of natives, Rajputs and Babhans. A few cases of gastro-intestinal plague were found. Evacuation of villages showed its best effects when carried out at an early stage, when rats were dying. Towards the end of the year a demand for inoculation arose. In the Gaya district plague was first detected in October in the new town of Gaya. An unusual mortality among rats was soon observed, and the plague bacillus was identified in their blood. Voluntary inoculation was extensively resorted to in Gaya, and became so popular that a whole village asked to be inoculated as soon as plague came near it. In Saran up to the middle of January plague was only known to exist in two circles of the Sudder Subdivision ; but thereafter it was found that a village eight miles east of Chapra was affected, and this proved to be the centre of an extensive spread of the disease. In the Bhagalpur Division the towns of Monghyr and Jamalpur, and several villages were affected. The first outbreak occurred in the villages of Ganga Serai and Jaidpur, near the border of the Patna district, whence the infection was imported. Pneumonic plague was prevalent. An extraordinarily insanitary practice prevailed, the use of large deep pits alongside the houses alternately as grain stores and as receptacles for house sweepings and refuse and for human and animal fæces. Into the town of Monghyr the disease was introduced in March by a Marwari, who had a wedding in his house, to which a large number of Marwaries from Calcutta were invited, with the result that presents of cloth and wearing apparel were brought from the infected localities of that town. Within a few days of the wedding two servants of the Marwari fell victims to plague, and the Marwari himself and his daughter died of the disease. From this centre plague spread very gradually to different parts of the town, by infected people being taken from place to place. It was noticed that mehtars and domes suffered very severely in the town, and women and children far more than men. The civil surgeon reported that many cases occurred of plague breaking out again in disinfected houses, because the disinfectant did not get a proper chance, and was of opinion that the only effective measure is evacuation.

Plague in the City and Port of Calcutta.—The recrudescence of plague in Calcutta in 1900 began in Ward V, and by the end of March it was raging more or less severely in seventeen wards. As in previous years, the wards most seriously affected were generally those in the northern half of the town. The epidemic of 1900, which consisted of 8,822 seizures and reached its culminating point in March, was much more severe than that of the previous year, which had attained its climax in April. Ward V. is composed of bustees of the most filthy condition, and of high masonry buildings divided up by streets of the narrowest possible dimensions, which from their narrowness are useless for ventilation, and are rendered more so by the hanging verandahs on both sides of the streets. The plague authorities of Calcutta have not made up their minds as to the part to be ascribed to rats in the spread of the disease ; but, unlike most other plague authorities, appear to have satisfied themselves that "disinfection is efficacious, while evacuation is unnecessary." Meanwhile the disease has been seriously increasing every year in virulence, and threatens to continue to do so.

No case of plague was found on any of the 462 vessels which arrived during the year from infected ports, and no "infected" ship arrived. Among the crews and passengers of outgoing vessels no case was detected, though it is not known whether some of the rejected persons may not ultimately have developed plague.

Plague in the Punjab.—As far as British districts are concerned, plague in the Punjab was confined to two well-defined areas in the Jullundur and Hoshiarpur districts and in the Gurdaspur and Sialkot districts. During the first half of the year plague was limited to the former of these two areas. This epidemic had begun in October, 1899, and was at its height during the month of March, 1900, though it was severe from February to May. It completely subsided during June, but was followed by another outbreak in October. Early in November a village in the Gurdaspur district was declared to be infected ; and subsequent investigations tended to show that the disease had probably been introduced the previous May by a man who had returned from Bombay and Kurrachee. The disease had remained latent during the hot weather ; but broke out in October, and by the end of the year had attacked six villages in the district and two in the Sialkot district. In

the Punjab 308,048 inoculations were performed, all but a small minority in the Jullundur and Hoshiarpur districts. The only outbreak in the native states dependent on the Punjab was at a village in the Patiala State, situated not very far from the Jullundur-Hoshiarpur infected area, whence, in all probability, the disease was introduced in March.

Plague in the North-Western Provinces and Oudh.—Out of a total of 170 cases with 135 deaths, 145 cases with 115 were recorded in the Mau Aima circle in 1900. Elsewhere 25 cases occurred, of which 20 were imported. The Cawnpore district had six, and the Mirzapore district five ; and cases occurred also at Benares, Agra, etc. The village of Mau Aima in the Allahabad district contains about 6,000 inhabitants, mostly Muhamadans, including about 1,500 *julahas* (weavers). Plague was introduced by a *julaha*, who, with his son and daughter, arrived from Bombay city on the 24th November, 1899. Some of the inhabitants left the village at the first alarm, and went to other villages, and there was the further danger that at that time a large number of *julahas* were returning to the neighbourhood from Bombay, having been thrown out of work by restrictions of employment in the Bombay cotton mills. The Lieutenant-Governor therefore ordered that a large tract of country in the Allahabad and Pertabgarh districts should be brought under a system of inspection similar to that previously established at Hardwar and in some of the eastern districts. On the 17th and 24th January more cases occurred outside the evacuated area at Mau Aima, and it was resolved that the entire village should be evacuated. This was effected by the 2nd February, and the actually infected houses and those adjacent to them were burnt. Similar measures were carried out in three neighbouring villages, which had become infected. The result was quite successful, and all four villages were re-occupied in May and June.

Plague in the Central Provinces.—In the Central Provinces in 1900 there were 634 cases and 590 deaths from plague, of which 627 cases and 585 deaths occurred in the Nagpur district and 527 cases and 493 deaths in Nagpur city. All the deaths among indigenous cases occurred in the Nagpur district. The Nagpur plague of 1900 was a continuation of the second outbreak of 1899, which began in August of that year. The plague in Nagpur city was pretty generally diffused over the city, but was most severe in the Itwari quarter, especially in circles 14 and 15, which are the most densely crowded and dirtiest parts of the city. Five plague villages in the district were infected from Nagpur city, one in 1899 and the others in 1900. In the case of the latter, thanks to the prompt and adequate measures adopted by the authorities, the disease was soon stamped out. The districts of Wardha, Nimar, and Bhandara had only seven cases and five deaths between them, and none of them were indigenous

Plague in Mysore, in the Madras Presidency, and in Madras City.—The epidemic in Mysore was very widespread, no district escaping altogether, though Hassan, Chitaldroog and Kadur had only a few cases each.

The Madras Presidency as a whole was not affected, the indigenous cases throughout the year having been confined to the Salem district, chiefly to the Hosur taluk, which is in immediate juxtaposition to Mysore, a result only attained by great efforts and unceasing watchfulness. The plague followed a very similar course to that taken by it in the preceding year. The severe outbreak in Tiruppatur, alluded to in last year's report, was almost exactly duplicated in regard to point of time, insidious and unrecognized onset, gradual spread, etc., in the neighbouring town of Vaniyambadi, inhabited by Muhamadans of a very ignorant and obstructive race. The relationship between plague and temperature was as clearly marked as usual. No fewer than 57 cases were imported to Bellary, Ganjam, Chingleput, North Arcot, Vizagapatam, Madras, South Canara, Nilgiris, Tinnevelly, Anantapur, Trichinopoly, and Malabar ; but in none of them did the disease obtain a foothold

Plague in Hyderabad State.—Plague was at its maximum in Lingsugur in January, rose again in March, but after September completely disappeared from the district. The disease subsided still more rapidly in Naldurg, and by April had become extinct in that zilla. There were small outbreaks in the districts of Bidar, Gulbargah, and Aurangabad, but they were of short duration, and easily stamped out. The dominions were free from plague from the 16th September to the 24th October. The disease was, however, imported from Nasik into Begumpura, a suburb of Aurangabad city, on the 25th October by a Brahman clerk, who had contracted it from his mother in Nasik. This outbreak in Aurangabad reached its greatest height in the last week in December ; but, as it had been discovered at an early period in its development and promptly combated, it never attained the dimensions of a serious epidemic, and did not spread beyond the suburbs or invade

other districts. This result is said to have been due to the kiln method of disinfection, and to the detention of all suspicious passengers at the three observation camps. In all there were in the Hyderabad State 771 attacks. The total number inoculated in the dominions was 634.

Plague in Rajputana, Berar, Burma, and Baluchistan.—None of the 12 cases recorded in Rajputana were indigenous : they were all imported from plague-infected areas, and detected by the inspecting officials at the railway stations. There were two fatal imported cases, one suspected and the other undoubted, at Khamgaon in Berar, the former coming from the Bombay direction, the latter from Rajputana. Four cases were imported into Burma from Calcutta by sea, two of which at least were undoubtedly plague. In one case the disease did not manifest itself for six days after the infected area had been left. In Baluchistan two fatal cases occurred at Naka Khari in Las Bela State. The two men were travellers by road from Kurrachee to Son-Miani, and had contracted the disease at Kurrachee.

Fevers.

The fever mortality ratio of India increased by nearly 19 per cent., and was nearly 11·5 per cent. above the quinquennial ratio ; the number of deaths rising from 4,126,384 to 4,919,591. The increase affected all the months of the year, but was especially great in the last four. The heading "fevers" includes, of course, many cases for which a more definite diagnosis might be desired, and Garvie has shown reason for believing that many cases of influenzal pneumonia are so included ; but the experience of the other classes of the population already related shows that there was a decided increase of malaria during the year. With reference to the remarks recorded on page 196 of the report for 1898, it is interesting to note that Celli states that the waters in which hemp, and to a certain extent those in which flax, is macerated, during, and some time after the maceration, kill the anopheles larvæ. In Burma the steady and progressive increase in the number of packets of quinine issued to vendors for disposal goes to show that the drug is slowly gaining popularity with the people. In Assam fevers were less prevalent than usual, and this is believed to be the reason why the sales of quinine fell off. The total given for fevers includes 9,036 deaths from *kala asar*, nearly all of which occurred in the districts of Goalpara, Kamrup, Darrang, and Nowgong. But lately portions of the Sylhet district have become affected. In Bengal the year was an unhealthy one, and this was thought to be connected with the deficient and irregularly distributed rainfall. The greatest number of deaths occurred, as usual, in the period following the cessation of the rains. A special report was submitted to Government on the growing unhealthiness of Faridpur, which is supposed to be due to the silting up of the rivers, and to be aggravated by certain local causes. It is said that in Bengal the proportion of deaths returned as from fever is diminishing owing to more skilled diagnosis. The largest sales of quinine corresponded generally with the period of highest mortality from fever. In the Port of Calcutta there were 6* deaths from enteric fever among the European seamen, and 61 from fevers in the native floating population. The Sanitary Commissioner of the North-Western Provinces and Oudh fears that, even with the best system of drainage, the inhabitants of irrigated districts must expect to pay for their abundant crops and independence of rainfall by a somewhat higher death-rate from malarial fever, especially in a wet year. Quinine was sold in the post offices of every district ; it was sold by vaccinators in the majority of districts ; and the experiment of selling it through landlords or their agents seems likely to be successful. A great rise in the fever mortality of the Punjab took place in September in consequence of the heavy rainfall in that month. In certain districts quinine was freely and gratuitously distributed by vaccinators, zaildars, lumbardars, and the medical staff ; and the Sanitary Commissioner recommends the further development of the arrangement. In the Central Provinces the fever appeared to be of the ordinary malarial type ; but there was reason to suspect that deaths from acute dysentery and diarrhœa and other diseases were included. No cases of "famine" or relapsing fever were observed by or reported to the Sanitary Commissioner. The increase of fever in Berar was general in all the districts. Owing to the drought, fevers were not very prevalent in the beginning of the year. Afterwards influenza became prevalent, then simple continued fever ; but, after the rains began, the malarial type prevailed. All these were registered under the head of "fevers." Hepatic complications with symptoms of

* 17 out of 22 cases were admitted from one steamer from a South African port. In the filters were found "organisms which resembled those of enteric fever," and in the firemen's water "an organism which appeared to belong to the higher grades of the coli group."

jaundice were common, not only among the general population, but also in the jails, and in the Hyderabad Contingent. The low death-rates in certain towns of Madras are believed to have been due to a large proportion of the deaths from fevers in these plague-infected localities having been registered under "other causes" to avoid the inquiry as to the cause of death consequent on a report of "fever." In Bombay the number of deaths registered was the highest for ten years past. In some of the districts the increase was to a great extent due to famine causes. A sharp watch was maintained for relapsing fever in the famine tracts, but expert bacteriological research failed to detect it. In two districts an anomalous statistical result was the means of showing that cases of cholera during an epidemic had been returned as "fever."

Statement showing the deaths from Fevers registered in the different Provinces by Months during the year 1900.

PROVINCE.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL.	RATIO OF DEATHS PER 1,000 OF POPULATION.	
													1900.	1900.	1899.
Bengal	173,321	114,742	131,923	146,797	127,353	107,328	130,241	122,383	122,815	174,281	167,749	184,671	1,703,804	23·97	22·61
Assam	7,121	5,512	5,743	5,983	6,930	6,755	6,370	6,337	6,377	6,937	6,903	6,589	77,557	14·70	18·04
North-Western Provinces and Oudh.	88,747	69,872	76,173	84,451	94,210	99,074	79,123	86,625	96,669	114,528	114,210	102,348	1,106,030	23·58	26·55
Punjab	37,013	28,175	27,225	29,770	37,157	39,004	40,191	39,060	66,351	129,170	125,410	87,369	685,895	33·37	18·57
Central Provinces*	12,547	12,045	14,345	17,080	17,759	24,475	28,204	34,496	35,581	35,100	24,010	17,041	272,683	28·70	16·17
Berar	5,067	4,836	5,592	5,778	6,920	7,163	9,085	10,460	9,865	9,258	5,954	4,039	84,017	29·45	17·50
Lower Burma	3,626	3,495	3,637	3,546	3,254	4,051	5,130	5,123	4,511	4,413	4,615	4,487	49,888	11·18	11·47
Upper „	1,639	1,265	1,558	1,755	1,390	1,447	1,555	1,496	1,565	1,617	2,024	2,564	19,875	8·10	7·91
Madras Presidency	22,181	19,126	20,991	20,049	22,464	24,589	25,656	26,974	24,800	25,886	26,625	29,180	288,521	8·74	7·32
Bombay „	32,089	30,558	39,260	40,969	53,295	45,304	53,650	58,633	51,245	50,928	47,328	40,060	543,319	28·87	12·14
Ajmer-Merwara	2,420	1,953	2,286	2,552	2,923	2,757	2,446	2,739	4,096	6,633	7,323	6,108	44,236	81·56	23·42
Coorg	314	242	283	531	370	533	639	491	440	416	373	408	4,240	27·97	23·10
Mysore	2,985	2,673	3,370	3,730	3,209	2,605	3,249	3,144	3,172	3,264	3,901	3,624	38,926	8·04	7·47
Total	389,070	294,494	332,386	362,791	377,234	365,085	385,539	398,161	427,487	562,431	536,425	488,488	4,919,591	22·32	18·69

* Excluding Zamindaries.

Dysentery and diarrhœa.—The mortality ratio for bowel complaints for India rose by more than 111 per cent. and the number of deaths from 252,025 to 530,654. The ratio was also nearly 94 per cent. above the quinquennial ratio. The increase ran through all the months of the year, but was most marked from the beginning of March to the end of September. The high death-rate in the Meiktila district is noted as having been probably due to a contaminated water-supply. The Sanitary Commissioner of Assam cannot understand why the death-rate from acute bowel complaints should always be so much higher in the Sibsagar and Lakhimpur districts than elsewhere, and is causing inquiries to be made. It is stated that in Bengal the increase was chiefly due to causes which contributed to the greater prevalence of cholera; but most of the worst districts have had high mortality for several years past. The mortality was greater in all but four districts. There were 7 deaths among the European seamen of the Port, and 9 in the native floating population. The increase in the Punjab was most marked in the famine districts, especially Hissar. The points of causation noted by the Sanitary Commissioner of the Central Provinces are the failure of the rains in 1899, leading to the use of foul, stagnant, concentrated water from pools; the carrying into the water channels by the rains of 1900 of an unusual accumulation of impurities; the inferior quality of the articles of diet on which the people had to subsist; the ravenous consumption of indigestible vegetables when the rains had set in. The causes cited by the Sanitary Commissioner of Berar are much the same, namely, the consumption of bad jowari and of imported peas to which the people were not accustomed; the want of fresh vegetables during the cold and hot weather, with a scorbutic taint as result; the use of bad water owing to the water-famine;

gorging with green fresh vegetables after the onset of the rains. In Bombay the increase was even greater than in the famine year of 1897. These complaints were most prevalent in Gujarat during and just after the rains, when damp and chills were added to the chief cause—unsuitable food, which consisted of badly cooked or raw grain, grass seeds, leaves, bark, roots, anything that would help to fill the void.

Statement showing the deaths from Dysentery and Diarrhœa registered in the different Provinces by Months during the year 1900.

PROVINCE.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL. 1900.	RATIO OF DEATHS PER 1,000 OF POPULATION. 1900.	1899.
Bengal	4,814	3,670	4,687	5,208	4,770	4,088	5,667	5,649	5,585	6,790	6,653	7,083	64,664	0·91	0·58
Assam	1,201	857	946	1,153	1,348	1,478	1,396	1,441	1,222	1,370	1,358	1,226	14,996	2·84	2·74
North-Western Provinces and Oudh.	1,810	1,457	1,802	2,568	2,846	2,831	2,563	3,129	3,288	3,166	2,672	2,520	30,652	0·65	0·56
Punjab	1,109	744	952	1,451	1,698	1,441	1,514	2,148	3,383	4,814	4,053	2,606	25,913	1·26	0·65
Central Provinces*	1,380	1,501	2,023	2,596	2,670	3,947	6,832	8,863	8,812	5,486	3,152	1,800	49,062	5·16	1·25
Berar	2,812	2,994	3,654	3,603	4,144	5,157	9,301	11,413	9,794	5,986	3,104	1,898	63,860	22·39	7·10
Lower Burma	545	495	448	586	679	797	1,277	1,193	823	477	435	462	8,217	1·84	1·81
Upper „	57	40	53	55	89	106	164	177	118	84	80	81	1,104	0·45	0·75
Madras Presidency	2,785	2,194	2,459	2,447	3,250	3,730	4,013	4,291	3,692	3,211	3,197	3,589	38,858	1·18	0·93
Bombay „	10,546	12,611	18,726	21,212	24,301	19,961	30,251	31,439	22,463	13,006	7,733	5,994	218,243	11·59	3·97
Ajmer-Merwara	389	490	695	878	1,079	748	818	1,028	1,014	724	444	344	8,621	15·90	2·14
Coorg	8	5	4	7	20	33	25	27	28	14	24	11	206	1·19	0·64
Mysore	534	407	462	462	447	400	622	723	640	605	504	452	6,258	1·29	1·41
TOTAL	27,990	27,435	36,911	42,226	47,341	44,717	64,443	71,521	60,862	45,733	33,409	28,066	530,654	2·41	1·14

* Excluding Zamindaries.

Vaccination.

Vaccination in India as a whole.—The abnormal and untoward conditions which the population of large areas had to face during the year have been the constant subject of remark in the two preceding sections. It might then have been predicted that in the Punjab, the Central Provinces, Berar, Bombay and Ajmer-Merwara there would be a considerable falling-off in the work of vaccination, and a large increase in the prevalence of small-pox, and such indeed has been the case. The contributary causes may be briefly stated; famine and epidemic disease prevailed in these areas; the birth-rate was exceptionally low and the infantile morbidity and mortality exceptionally high; the ordinary avocations of the people were suspended, families were broken up and many of the people wandered far from home in search of work and relief; the vaccinating staff of all grades were largely occupied in carrying out relief and sanitary arrangements and consequently their ordinary functions, inspecting and executive, suffered; and, lastly, the congregation of children at the susceptible age in relief camps where they were brought into contact with destitute refugees from Native States where the protection afforded against the disease is very inadequate, set up conditions favourable to the spread of small-pox.

A decline in the total vaccination operations performed among the civil population of India during the year 1900–01 was therefore inevitable, the aggregate number having fallen from 8,125,337 operations in 1899–1900 to 7,874,392 during the year under

review, yet the result is better than in either of the years 1897–98 and 1898–99, when the totals stood at 7,829,983 and 7,515,527 respectively. Compared with the preceding year, the results of 1900–01 exhibit a decline in Assam, Burma, the Punjab, the Central Provinces, Berar, Bombay, and Ajmer-Merwara; as regards the five latter areas the causes have been sufficiently indicated. In Assam the decrease was insignificant, and to the case of Burma further allusion will be made in the course of this review. Elsewhere, on the other hand, where the above-mentioned untoward conditions were absent or less marked a satisfactory increase in the work has to be noted.

The effect of the presence of plague which has been the subject of remark in previous reports has not altogether disappeared, but it is markedly less as the people are becoming acquainted with the true purpose of preventive operations.

Comparing the year under review with that immediately preceding, the primary vaccinations in the aggregate fell from 7,500,113 to 7,235,020, but the re-vaccinations rose from 625,224 to 639,372, which is evidence on the one hand of the results of the high infantile mortality and the diminished birth-rate, while the increase in re-vaccination was largely due to the greater energy displayed in Bengal, where alone the number rose by about 7,000 cases above that of the previous year. The ratio of success obtained in primary cases was, on the average, 94·5 per cent. against 94·6 per cent. the year before; and for re-vaccinations 64·4 per cent. against 58·7.

As in the previous year, Ajmer-Merwara reported the highest result as regards the percentage of success in primary vaccination, *viz.*, 99·2 per cent., and Madras again takes the lowest place with 89·2 per cent. In re-vaccination the Central Provinces takes the lead with 83·8 per cent., Berar again occupying the last place with 20·9 per cent.

The variation in the result recorded for primary operations is largely due to the use of different kinds of lymph and lymph compounds, which are now on their trial in India, where the conditions vary so greatly in different areas; the range in the success claimed in re-vaccination must, to some extent, be attributed to the differences that prevail in the protection afforded by the primary operation, but much more, it is to be feared, to a lax interpretation of the proper standard of success, a most important matter which is receiving attention.

The foregoing details relate to the combined work of the special staff and of the dispensaries. For the former a total of 7,076,514 primary operations is recorded, 6,700,990 of which (94·7 per cent.) were successful, and 579,274 re-vaccinations, 378,640 of which (65·4 per cent.) were successful.

As to dispensaries no operations were conducted at such institutions in Berar and Ajmer-Merwara. Elsewhere 145,252 primary operations were performed, of which 92·9 per cent. were reported as successful, and only 60,098 re-vaccinations, of which 55·4 per cent. were successful.

With the decline in the total combined operations noted above, only 31·8 per 1,000 of the population can be regarded as having been protected from small-pox, while the year before the estimate stood at 32·86 per 1,000. As the population figures are, however, those of the census of 1891, the figures are necessarily subject to correction, the difference on the aggregate population only amounting, however, to about four per cent.

The average number of operations to the credit of each operator was highest in the Punjab, *viz.*, 2,590, Berar following close with 2,449; Burma next with 2,160. Ajmer-Merwara stands last on the list with 763 operations per vaccinator, due to the decline of work in the province, which was severely affected by famine.

The protection afforded to the infant population is at the rate of 33·9 per cent. of the births calculated on a hypothetical birth-rate of 40 per 1,000 of the population, which is an improvement on the record for the years 1897–98 and 1898–1899, but less than that for 1899–1900, when 38·11 per cent. of the infants were protected on the same computation. The percentages ranged from 55·7 per cent. in the Punjab, to only 12·2 per cent. in Coorg, the lowest returned: the next lowest ratio was 20·7 per cent in Bengal.

The ratio of deaths per thousand of population due to small-pox, which in the calendar years 1898 and 1899 had been 0·26 and 0·23 respectively, rose in 1900 to 0·41; the circumstances leading to this result have been referred to. The increase was most notable in the areas affected by famine, while elsewhere, generally, there was a decrease, *viz.*, in Assam, the North-Western Provinces and Burma.

The total expenditure incurred by the Department in 1900–01 was £77,000 compared with £73,200 in 1899–1900, and each successful case cost 2 annas and 7 pies, against 2 annas and 5 pies in the previous year. The provincial rates ranged from 8 annas and 2 pies in the Bombay Presidency to 1 anna and 4 pies in Bengal.

Total Primary and Re-vaccinations, successful cases among the children, cost of the Special Vaccination Department, during the official year 1900–01.

Province.	Number of Persons vaccinated by the Special and Dispensary Staffs combined.		Percentage of Successful Cases to Total Operations.		Number of Children successfully vaccinated by the Special and Dispensary Staffs combined.		Average number of operations performed by each vaccinator of the Special Staff.	Total Cost of the Special Department.
	Primary.	Re-vaccinations.	Primary	Re-vaccinations.	Under One Year.	One to Six Years.		
								R.
Bengal	2,227,942	118,369	97·8	59·2	589,376	1,404,838	951	1,88,115
Assam	251,219	20,247	96·0	80·0	52,146	131,457	1,005	22,833
North-Western Provinces and Oudh	1,486,349	63,060	95·2	82·5	831,483	510,483	1,708	1,37,470
Punjab	627,754	154,742	94·4	63·0	462,392	118,918	2,590	1,01,539
Central Provinces	385,493	69,904	96·8	83·8	218,824	115,483	1,563	49,417
Berar	74,707	33,081	96·6	20·9	54,551	14,180	2,449	18,617
Madras	1,181,375	76,508	89·2	69·7	350,763	539,188	1,473	2,60,277
Coorg	10,070	1,979	93·2	74·7	847	4,756	1,264	2,836
Bombay	587,146	73,855	90·8	56·9	405,823	112,653	1,548	2,91,188
Burma	392,305	27,606	91·2	49·9	109,009	174,863	2,160	78,854
Ajmer-Merwara	10,660	21	99·2	61·9	7,286	2,594	763	2,316
Total	7,235,020	639,372	94·F	64·4	3,083,500	3,129,413	1,377	11,53,462

Vaccination operations performed by the Special and Dispensary Establishments separately, deaths from Small-pox, etc., during the official year 1900–01.

Province.	Population.	Number of Persons vaccinated (Primary and Re-vaccinations combined).			Ratio of successful vaccinations per 1,000 of population.	Percentage of annual estimated births at 40 per 1,000 of population successfully vaccinated.	Deaths from Small-pox*.	
		By Special Department.	By Dispensary Staff	Total.			Number.	Ratio per 1,000 of population.
Bengal	71,050,302	2,201,891	144,420	2,346,311	31·6	20·7	20,620	0·29
Assam	6,122,201	253,562	17,904	271,466	42·0	21·7	975	0·18
North-Western Provinces and Oudh	47,146,033	1,549,233	176	1,549,409	31·1	44·1	1,410	0·03
Punjab	20,750,040	782,045	451	782,496	33·3	55·7	10,425	0·51
Central Provinces	12,944,805	437,596	17,801	455,397	33·4	42·3	8,021	0·76
Berar	2,897,040	107,788	—	107,788	27·3	47·1	830	0·3
Madras	35,651,577	1,245,719	12,164	1,257,883	31·0	24·6	27,692	0·8
Coorg	173,055	11,380	669	12,049	62·8	12·2	314	1·81
Bombay	22,197,220	658,636	2,315	661,001	25·9	45·7	9,885	0·52
Burma	8,146,855	410,461	9,450	419,911	45·6	33·5	5,803	0·84
Ajmer-Merwara	542,358	10,681	—	10,681	19·5	33·6	2,610	4·81
Total	227,621,486	7,669,042	205,350	7,874,392	31·8	33·9	88,585	0·41

* For the calendar year 1900.

Animal Vaccination.—As usual, the majority of the vaccination operations conducted in the country were carried out with bovine lymph, either pure or in combination: still humanized lymph is the staple protective medium resorted to in certain areas, notably in the North-Western Provinces and Oudh, though calf-lymph has long been prepared on a small scale in some of the larger towns for local use. But a site for a large central depôt in the Hills near Naini Tal has been selected and plans and estimates for the necessary buildings are under preparation, and it is confidently anticipated that, at no distant date, animal lymph will be available for the entire province, and that the present arm-to-arm system will be gradually superseded. In Bengal, in addition to the vaccine depôts at Calcutta and Darjeeling, one is to be established at Pusa, and the Provincial Sanitary Commissioner advocates another at Orissa. In Burma the Taunggyi vaccine depôt was closed owing to the generally bad quality of the lymph produced there; the entire supply required for the province is to be prepared at the Rangoon depôt, pending the construction of a new depôt at Meiktila or other convenient centre: plans for the building are under preparation, and the plant has been ordered from England. There is no mention in the provincial report of the contemplated central vaccine depôt for the Madras Presidency, but it is known that active steps are being taken in the matter for establishing one in connexion with the Bacteriological Laboratory which is projected.

As regards the several kinds of lymph used, it will be convenient to note the facts when dealing with the work in each provincial area. As already mentioned, the whole important subject of the best form of lymph for use in India is now on its trial. The experiences of recent years have served to bring to notice the rival claims of various calf-lymph compounds, no one appearing, at the present stage of enquiry, to possess exclusive advantages. Owing to various circumstances—differences in climate, and the absence of Deputy Sanitary Commissioners on plague duty, &c.—many questions still await solution, but experiences are being exchanged, comparative tests will be rigidly employed, and the results will be more fully and accurately recorded.

As the main features of this review present some marked departures from the practice followed in previous years, it may be well to indicate here that particulars as regards the work performed by the Dispensary staff as distinguished from that done by the special staff will not be further discussed in the text, as they are given in the above tables. The same remark applies to the average work performed by each vaccinator, to the percentage of available infants protected, and to the cost of the Department in each Province. No allusion has been made to the *personnel* of the staff, as this is now definitely established and has been described again and again in previous reports; moreover, no reference will this year be made to the results (as regards the quality of the work) of the tests applied by the inspecting staff, as, generally speaking, the returns do not distinguish between primary cases and re-vaccinations in this respect. This is a matter in which reform is very desirable, and the necessary orders have been issued to local authorities and the distinction will be observed and reported in future. The following sketch will be confined to a broad statement of the general results of the work, in quantity and quality, together with a brief allusion to the kind of vaccine or compound lymph employed.

Bengal.—Including the dispensary work a total of 2,346,311 operations were performed against 2,252,521 in the preceding year. Of this number 2,227,942 were primary cases and 118,369 re-vaccinations, the corresponding figures for 1899-1900 being 2,203,984 and 48,537, which shows an increase in both classes of work, which is very marked in the latter. The success attending the work was also better, 97·75 per cent. of the primary cases and 59·22 per cent. of the re-vaccinations proving successful, while the year before the rate per cent. was 97·67 and 49·59 respectively.

The aggregate increase of 93,790 operations was not equally distributed all over the province: 31 districts show an increase and 18 districts a decrease on their respective results during the previous year—Mymensingh, which in 1899–1900 reported a great improvement, was at the head of the list in the year under review, with an increase of no less than 16,492 cases.

As regards the districts where a decrease occurred, the causes assigned are generally the presence of plague, the effects of the floods of September, 1900, in inducing widespread prevalence of malaria and cholera.

In response to the Sanitary Commissioner's remarks in last year's report, the protection of infant life in municipalities has received more attention. Deducting the number who died before completing the first year of life from the total number of births recorded in the year, 60 per cent. of the remainder were successfully vaccinated against 44 per cent. in the previous year. This, while a decided improvement, still leaves much to be desired in places where the compulsory Act is in force.

During the year 280,502 primary operations were performed with calf-lymph, 220,347 with lanoline-lymph, and 1,727,093 by the arm-to-arm process. The ratio per cent. of success of these methods and media was 98·46, 94·54 and 98·04 respectively. The quantity of lymph the two depôts at Calcutta and Darjeeling are capable of supplying is said to be insufficient to meet the increased needs, especially as the arm-to-arm system is gradually being superseded, but steps are being taken to relieve the principal depôt of the duty of supplying vaccinated calves and lymph to the Calcutta municipality, which will no doubt go far to meet the difficulty.

The Nepal Darbar and the Sikkim State each received 440 and 2,458 grains of lymph respectively from the Darjeeling depôt ; no record of the results appear to have been received, and as regards the former only it is merely said that they were excellent.

Assam.—The operations during the year numbered altogether 271,466 or 799 less than in 1899–1900, and this represents the work of all the agencies employed.

The primary operations amounted to 251,219 and re-vaccinations to 20,247, while in the preceding year the corresponding figures were 255,131 and 17,134 respectively ; the percentage of success was 95·99 in primary cases and 79·99 in re-vaccinations, results which are lower than in 1899–1900, when 98·50 per cent. of success was claimed for the former and 88·90 for the latter. This decline is apparently due to the inferior quality of the first two supplies of lymph issued at the beginning of the season, a defect which was promptly rectified.

The distribution of the work among the staff shows the paid and licensed vaccinators and apprentices to have performed 240,308 operations, an increase on the 236,031 cases to their credit the previous year, and the dispensary staff only 17,904, or about three-fourths the results of 1899–1900.

The work of the Tea Garden Agency increased from 11,519 to 13,254 : these were exclusively primary cases.

The percentage of success in the primary work was 96·16 for the paid staff, 94·26 for dispensaries and 95·32 for the Gardens Agency : in re-vaccinations the paid and dispensary staffs secured success at the rate of 79·58 and 88·18 per cent. respectively.

The Compulsory Vaccination Act was not further extended and continued in operation in 11 towns, wherein 70 per cent. of the available children under one year of age were vaccinated.

The Vaccine Depôt at Shillong continued to work successfully, and 387,557 tubes were loaded with calf-lymph, which is the highest number on record at the depôt : in 1899–1900 317,382 tubes were filled. The work of the province was entirely performed with this lymph, which in expert hands yielded a percentage of success of over 98 on all cases operated on. The experiments to test the effects of storage on glycerinated lymph, referred to in this report for 1899, were being continued during the year under review.

North-Western Provinces and Oudh.—In the aggregate 1,549,233 operations, an increase of 37,797 on the results of the preceding year, were performed by the special staff in 1900–01, there being 36,522 more primary cases and 1,275 more re-vaccinations, which is a continuation of the progress noted last year. The percentages of success attained were 97·30 and 85·33 as compared with 97·00 and 81·93 in 1899–1900 for primary vaccination and re-vaccination respectively, and thus the steady improvement noticed in the course of the last four years has been maintained. This progress is most satisfactory, especially when it is borne in mind that some of the most experienced vaccinators were deputed to plague and other special duty, and extra caution was necessary in districts where plague prevailed, especially so in the districts of Ballia and Benares.

Vaccination in municipalities declined by 3,381 successful primary operations, and the proportion of persons successfully vaccinated fell to 36·60 per 1,000 of population from 37·97 per 1,000 in the previous year. As stated in the preceding year's report, though the Vaccination Act is in force in all municipalities and cantonments, its provisions are enforced with a varying degree of energy, and here there is certainly room for criticism and improvement.

The humanized lymph supply from the hills with which operations were started was of good quality and received in almost all districts on the plains on due date. Bovine lymph depôts were maintained at Lucknow, Bahraich, and Allahabad, but chiefly for the supply of the lymph to vaccinators working in those localities. Calf lymph is used only to a limited extent at present in the united Provinces, arm-to-arm vaccination being generally practised ; the approaching establishment of a large central lymph depôt has been alluded to, and it is hoped that the present system will gradually be superseded.

Punjab.—The combined efforts of the staff resulted in a total of 782,496 operations, or 160,578 less than in 1899–1900, which latter figure includes 117,163 primary cases and 43,415 re-vaccinations. This decrease is attributed to there having been over 150,000 fewer births in the year compared with the number born in 1899, to the prevalence of famine and scarcity and of epidemic disease, which rendered children unfit for vaccination, to the difficulty in obtaining calves, and to the employment of vaccinators on cholera duty. The percentage of success was 94·44 in primary cases and 63·04 in re-vaccinations, while in the preceding year the results were 94·68 and 62·55 respectively.

No returns for the Native States which maintain their own staff have been furnished in the report for 1900–01, beyond the bare statement that 48,407 primary and 30,377 secondary vaccinations were performed.

The work of inspection is claimed, on the whole, to have been satisfactory, but it was only on the part of the Divisional Inspectors that there was an improvement on the amount of work recorded last year, while the percentage of successful cases to the total inspected was also much the same, save in respect to re-vaccinations inspected by Native Supervisors, who found only 32·16 per cent. successful against 77·59 the year before, a remarkable contrast which is significant of an awakening to an appreciation of a better standard.

The engagement of the Deputy Sanitary Commissioner on plague duties interfered with his vaccination work, and the recrudescence of plague has decided the Local Government to apply for the services of another officer to relieve the Deputy Sanitary Commissioner and set him free for plague duty.

The Punjab Vaccination Notes for the year under review afford no particulars as to the lymph depôt maintained, nor of the yield of vaccine therefrom, but comparative trials of vaseline vaccine and glycerine lymph were instituted on a small scale, the results being inconclusive, and they will therefore be repeated. The great majority of operations are performed with simple calf-lymph, a large and increasing proportion with vaseline lymph, while arm-to-arm vaccination is practised in a small minority. No comparative results are given in the report for the year under review.

Central Provinces.—The total vaccination operations in this Province numbered 437,596 or 46,939 less than in 1899–1900. Of primary cases there were 370,563 against 436,704 in the preceding year, and of re-vaccinations 67,033 against 47,831, that is, a decrease in the former and an increase in the latter. The percentage of success in the primary work was 96·97 and in re-vaccinations 84·73, while in the preceding year the results were 96·50 and 82·73 respectively.

The primary operations in both the British districts and in Feudatory States declined from 354,655 and 82,049 to 303,559 and 67,004 respectively, though the percentage of success was higher, 97·13 per cent. in the former area against 96·65 the year before and 96·23 against 95·82 in the latter area. The number of re-vaccinations however rose from 41,739 to 52,054 in British territory, and from 6,092 to 14,979 in the Native States. The percentage of success in the former was 84·94 against 81·32 in the previous year, and in the latter areas, 84·02 against 92·42 in the year before, results which give rise to grave suspicion.

The explanation of the decline in primary work is the low birth-rate and the heavy infantile mortality, combined with the closure of famine camps, which had in the previous year afforded facilities for vaccinating a large number of children. As regards the increase in re-vaccinations, this is said to be due to the greater attention paid to the matter in consequence of the comments of the Chief Commissioner on the previous year's results, which were not held to be satisfactory.

At dispensaries in addition to the foregoing 17,801 operations, 14,930 primary and 2,871 re-vaccinations, were performed: this is 6,987 less than in 1899–1900. A decrease of over 5,000 primary operations occurred at dispensaries in the British districts, where also re-vaccinations fell to nearly half the number recorded in the previous year. The reasons assigned are that no work was done at two institutions, and that poor-houses and kitchens, where in the preceding year much work had been done, were closed.

As in the previous year four kinds of lymph were used, *viz.*, plain calf-lymph, humanized lymph, glycerine lymph and lanoline lymph, nearly two-thirds of all cases being treated with the first named which yielded success at the rate of 95·6 per cent.: glycerine lymph again gave improved results, the percentage of success being 86·97 against 86·27 in 1899-1900 and 72·69 in 1898-99. The arm-to-arm process by which about 79,000 operations were done, gave successful results in 95·1 per cent., and the 25,000 cases in which lanoline lymph was used yielded, 99·5 per cent. of success.

Berar.—Owing to famine, the prevalence of epidemic disease and the absence of the staff on special duty connected therewith, the total number of operations during the year amounted to only 107,788 against 175,901 in 1899–1900 or a decrease of 68,113, and a decrease of 25,115 compared with the results of 1898–99. Of the total, 74,707 were primary operations and 33,081 re-vaccinations, the corresponding figures in the preceding year having been 120,772 and 55,129 respectively: of the former 96·6 per cent. and of the latter 20·9 per cent. were claimed as successful against 95·8 and 17·2 per cent. respectively in the previous year.

Owing to the famine, calves were not available in sufficient number and lanolinated calf-lymph, manufactured at Amraoti, was used from April to November, thereafter to the end of the working season fresh calf-lymph was employed.

Madras.—The total vaccination operations performed during the year in this Presidency numbered 1,245,719, an increase of 97,899 operations on the results of 1899–1900, of which 84,502 were primary cases and 13,397 re-vaccinations. The percentage of success in the former was practically the same as in the preceding year, *i.e.*, 91·9 and 91·8 respectively, while for re-vaccinations it rose from 76·2 to 77·3 per cent.

The total work done in municipalities increased by about 11,000 operations, and though there was an improvement in the district totals as a whole, yet in six districts there was a decline during the year. Various causes are assigned for this, the chief of which is the absence of members of the vaccination staff without substitutes, on census and other special duty: the lymph supply is also complained of as ineffective in certain places, and attention has been drawn to this.

On the whole the improvement noted last year is maintained, and the plague inoculation scare seems to have entirely disappeared.

As in previous years, four kinds of lymph were used to the following extent, with the results noted against each :—

—	Number of cases.	Percentage of success.
Fresh calf-lymph	210,960	98·8
Ditto in tubes and plates	70,045	94·8
Glycerinated lymph	404,232	91·5
Lanoline ,, ...	383.485	79·1 to 93·4

As usual fresh calf-lymph yielded the best results, and those from gylcerinated lymph show a steady improvement year by year. The locally prepared lanoline paste yielded success at the rate of only 79·1 per cent. in local fund areas, but it rose to 88·5 per cent. in municipalities, while the paste obtained from Bangalore yielded 93·4 and 92·3 per cent. of successful cases in the two different areas named respectively.

The projected establishment of a central lymph depôt for the Presidency has been alluded to.

Coorg.—The total work of the staff in this small province consisted of 11,380 operations, an increase on the number for 1899–1900, which was 9,996. Of the total 9,618 were primary cases and 1,762 re-vaccinations ; one-half of the primary cases were performed among children above one and under six years of age, an indication of the risk to which infants are subjected and which is a feature of other provincial reports ; the percentage of success secured in the two classes of work was 93·89 and 77·01 respectively, while in the previous year the corresponding figures were 94·93 and 76·48.

It is satisfactory to note that the recovery noticed in this report for 1899, from the effects of the plague inoculation scare, has been maintained.

The entire work done in the province was as usual effected exclusively with unmixed calf-lymph.

Bombay.—The total number of operations performed throughout the Presidency was 661,001, which is a decrease of 108,266 compared with the work of 1899-1900, of which latter number 92,917 were primary cases and 15,349 re-vaccinations. This is attributed

to the wide-spread famine and to the epidemic disease which lowered the birth-rate and raised the infantile mortality-rate and set up other adverse conditions to which allusion has already been made.

Of the number primarily vaccinated 532,845 or 90·86 per cent. of the cases were successful, the results in no less than 47,603 cases being unknown, while in re-vaccinations 42,062 or 56·96 per cent. succeeded : here also the results of 23,246 cases could not be ascertained chiefly owing to wandering life led by the people under the stress of famine and pestilence.

In the Native States also the primary cases fell from 185,162, the number recorded in the previous year, to 133,720, and the percentage of success from 95·76 to 92·66. But re-vaccinations rose from 7,116 to 9,756, the percentage of success being 65·76 against 70·04 in the preceding year.

Calf and humanized lymph were used during the year, but the relative results obtained are not stated ; it is intended in future to present a detailed statement of all the kinds of lymph employed, the extent of their use and relative results. Glycerine lymph was tried in Bombay City with encouraging results.

Burma.—The total number of operations performed was 80,426 less than in 1899–1900, *i.e.*, 410,461 against 490,887. The decrease was generally distributed, occurring as it did in 29 of the 38 districts, and is attributed to closer supervision of work and to the severe penalties imposed on the staff for bad work and for falsifying returns.

The details given in the report scarcely bear out the former reason, for Civil Surgeons are said to have inspected only 21·55 per cent. of the total operations and Native Superintendents only 14·92 per cent., against 22·91 and 14·13 per cent. respectively in the previous year, when a larger amount of work was performed. The number of primary operations fell off by 71,110, and re-vaccinations to the extent of 9,316, the percentage of success claimed for the former being 91·69 and for the latter 50·26, against 94·71 and 58·72 respectively in the previous year.

If these results indicate a better standard of work on account of stricter supervision, they are not to be regretted, the higher figures of previous years having apparently been inflated by false returns on the part of vaccinators. The working of the Burma Vaccination Law Amendment Act (Burma Act II of 1900) is not alluded to, and it is not clear if it was brought into operation during the year.

The work of the Department in Rangoon continues to be far from satisfactory. Only 2,265 primary operations and 2,677 re-vaccinations having been performed : returns which are even lower than last year, which were the lowest during the preceding quinquennium. A number of causes conduce to these poor results, the chief of which are the inadequacy of the staff, and of supervision. The total number of births recorded in Rangoon during 1900 was 3,143 and 1,186 infants died within the first year of life, leaving at the least 1,957 to be protected, whereas only 1,046 successful operations were performed on infants below the age of one year. The compulsory Act is in force, but is not enforced and the local municipal authorities are clearly responsible.

The lymph supply from the Taunggyi depôt proved to be generally defective, and this was attributed to prolonged storage before use and to exposure in transit to the site of the operations. The depôt was closed and the staff transferred to Rangoon, which will supply the entire province with lymph until buildings are erected for the proposed new depôt at Meiktila or other convenient station.

Lymph manufactured at the Rangoon depôt was issued in sufficient quantity for 60,000 operations, in compressible leaden capsules and glass capillary tubes, with satisfactory results.

The practice of inoculation is carried on throughout the province and unfortunately the sympathies of the people are in favour of it and against the legitimate operation. The local authorities have, however, not deemed it advisable to take steps to suppress inoculation by legal process, it being thought desirable, in the present stage of public opinion, to depend on vaccination to produce the desired effect on public opinion which in Burma is very backward in its appreciation of sanitary measures. The position in Burma, as regards small-pox and its prevention, would provide an excellent object lesson for the anti-vaccinator, the average death-rate from the disease during the past decade is 0·59 per 1,000 or just 50 per cent. higher than in India, and yet registration is very much more defective in Burma.

Ajmer-Merwara.—The staff performed a total of 10,681 operations, a very large decrease compared with the 27,080 operations recorded in 1899–1900. Of the number, 10,660 were primary cases and only 21 re-vaccinations, against 26,077 and 1,003 respectively in the previous year. The percentage of success secured in the primary work was slightly higher than the preceding year, *viz.*, 99·20 against 99·08, but in re-vaccinations it fell off, from 90·83 to 61·90 per cent.

As only advance statements giving the bare figures have been furnished, it is only possible to conjecture the causes which brought about this great reduction in the work of the Department. Famine and epidemic disease prevailed and militated against the work in the several ways to which allusion has already been made.

Civil Sanitary Works.

Bengal.—Two municipalities were added to the list in Bengal during 1899-1900, the number now standing at 153, excluding Calcutta, and their total income amounted to £312,306, of which 44·93 per cent. was spent on sanitary works (original and recurring), 11·38 per cent. on roads, and 30·8 per cent. on other requirements, the corresponding figures of the previous year being 44·75, 9·97, and 33·8 per cent., respectively.

Under ordinary sanitation charges nearly eleven lakhs were spent on conservancy, nearly 2½ lakhs on water-supply, and nearly 1⅓ lakhs on drainage, showing an advance under each head over the figures of 1898–99, the most notable increase (£2,600) being under water-supply, which was due chiefly to the extension of the filtered supply to new areas in Howrah and to special repairs to the pipe line in Darjeeling. An increase of nearly one lakh under other sanitary works is due to the large expenditure incurred in plague preventive measures. On original works only ten municipalities, or the same number as in the previous year, spent over 10 per cent. of income, 20 against 17 spent between 5 and 10 per cent. and 55 against 48 between 1 and 5 per cent., while 48 against 54 spent nothing on this account; the last number includes many important communities, and the fact calls forth a renewed protest from the Sanitary Commissioner against the lack of enterprise and public spirit displayed by these local bodies.

The total cost of various new works carried out by municipalities and District Boards, by Government and by private individuals, either completed or in progress, amounted in towns to £27,686 against £20,518 in the previous year, and in rural areas, to £33,131 against £36,626; a list of the more important of these undertakings, chiefly "tanks" and hospitals, is given but need not be detailed here.

The Sanitary Board held three meetings during the year, and business was also largely conducted by the circulation of papers to members. Among the more important subjects discussed were the improvement of the Darjeeling water-supply and the health conditions of the Hooghly riparian municipalities. The more important preliminary estimates prepared were those for the Patna waterworks and a combined scheme for the water-supply to the riparian municipalities.

Plans and estimates were considered, and an opinion given, on eleven important waterworks and drainage schemes, details of which are furnished and exhibit the valuable functions performed by the Board in its consulting capacity, which was also exercised in disposing of numerous miscellaneous references made by Government and by local authorities. The Sanitary Engineer inspected critically the waterworks in eight towns, and, in addition, visited several others in his consulting capacity for various purposes.

A useful report on the results of the sewage purification experiments conducted by the same officer at the Presidency jail was issued and distributed to the authorities of the larger municipalities.

Assam.—The total income of municipalities and local bodies during the fiscal year was £16,282 as compared with £18,395 in 1898–99; deducting the amount spent on "roads and bridges," the amount spent directly on sanitation was 44·69 per cent. of income, against 42·74 per cent. in the previous year.

Under conservancy £4,520 was spent against £5,302 in 1898–99; under drainage £713 against £827; and under water-supply £1,447 against £1,725. The proportion of income spent by local bodies on sanitary works ranged from 70·43 per cent. in the Habiganj Union to 18·8 per cent. in the Jorhat Union. A list is given of the various sanitary improvements effected by Local Boards in rural areas, chiefly in connexion with the extension and conservancy of the sources of water-supply, sinking of wells, excavation of "tanks," etc.

The Sanitary Board held three meetings during the year, and at other times views were exchanged by the circulation of papers.

North-Western Provinces and Oudh.—No details of the income, nor of the expenditure on sanitary works are furnished by the Sanitary Commissioner of the North-Western Provinces and Oudh in his report for the year under review, beyond the fact that £72,214 were devoted to the general purposes of conservancy, the sum thus spent in the previous year having been £64,751.

The more important sanitary works undertaken during the year included no new departure, but were in development of schemes already commenced, notably extensions of the sewage works at Benares, measures for the prevention of the pollution of the Ganges at the same place, and extensions and re-modelling of the waterworks at Cawnpore, Naini Tal and Mussoorie.

An important scheme for the drainage and sewerage of Cawnpore City was under consideration throughout the year, but any active progress in its realization will fall to be noticed in next year's report.

Along with these, much attention was paid to the improvement in detail of the waterworks in several of the larger cities, whereby the greater purity of the supply will be safeguarded and enormous wastage prevented. Very useful, if partial, works of drainage were either carried out or planned for the towns of Saharanpur, Aligarh and Farrukhabad. The detailed summaries presented by the Sanitary Commissioner and the Sanitary Engineer leave the impression that the local authorities are pursuing a vigorous policy of sanitary reform in the larger urban centres, and that, especially as regards the splendid waterworks that have been inaugurated during the past decade and which bring an excellent drinking supply to about one-third of the total municipal population, every care is devoted to all details of management and to improvement.

The amount of filtered water consumed per head of population where waterworks are in operation may be briefly stated as of interest for comparison with European standards. In Benares it was 12·7 gallons per head per diem ; at Lucknow, 4·1 gallons ; at Cawnpore, 10·5 ; at Agra, 8·2 ; at Allahabad, 9·4 ; at Meerut, 8 ; at Dehra, 6·6 ; at Mussoorie, 5·4 ; and at Naini Tal 9 gallons. It may be added that frequent systematic analysis of the water "showed good results" throughout the year, save only in that supplied to Agra, measures for the protection of which at the intake have since been carried out. It may be added that beyond the attention devoted to sanitary works in towns, rural areas have not been neglected, many improvements of a minor character having been effected as a result of the visits paid and reports made by medical officers in the course of their ordinary duties, and especially in connexion with plague preventive measures.

Seven meetings of the provincial Sanitary Board were held during the year, when projects and estimates amounting to £14,030 for the sanitary improvement of municipalities were considered. Various schemes for the extension and improvement of existing works for water-supply and drainage were considered, while plans for slaughter-houses and markets also received attention. The reports on the working of the Village Sanitation Act (1892) were read, and the Board noticed with satisfaction the increased attention paid to the conservancy of wells and the evidence of general improvement of the sanitary condition of villages to which the Act has been applied.

Punjab.—The aggregate income of all municipal towns in the Punjab for the fiscal year 1899-1900 was £387,238, including the opening balance, against £385,270 in the previous year. Altogether a sum of £88,691 or 22·9 per cent. of income was expended under all heads of sanitary works, a little over 1 per cent. less than in 1898-99, but this includes the expenditure on "roads and bridges" (£16,125), and if this be excluded the percentage falls to 18·7.

Under conservancy £42,724, under drainage £7,312, and under water-supply £19,240 were spent, or about £5,600 less under the second head, and about one lakh more under the last named than in the previous year, no material difference appearing under the first head.

The income derived from the sale of night soil for manure in all municipal towns amounted to £10,812 as compared with £9,521 in 1899 ; it is considered that far more should be realised if proper care were devoted to the subject to which attention is repeatedly directed.

The chief original works undertaken were extensions to the waterworks in Delhi, Simla, and in Fort Dalipgarh in Bannu district ; the water-supply scheme to the civil station of Dharmsala is under consideration. The Chandni Chauk section of the Delhi drainage works was nearly completed. The extension of the sewage works in Simla is in progress, and much was done towards the completion of the drainage scheme for Fazilka in Feroze-

pore. Three separate projects for the improvement of the drainage of Lahore city were practically completed, and similar works in Rawalpindi, Hazro and Abbottabad are in progress, while several other drainage schemes are under consideration.

As regards rural areas, a considerable amount of activity was displayed by most district boards; the village sanitary notebooks are in use in every district, and they are reported to be fulfilling the function for which they were designed. The Sanitary Board has drawn up a new inspection note-book from which much is hoped, and the system of granting monetary rewards to the village in each tahsil which shows most improvement is being developed, while at the same time the chief considerations which should influence a judgment in these awards were discussed and formulated.

There is indeed good evidence for the Sanitary Commissioner's statement that the cause of sanitary reform is generally progressing in the province, and that a greater impetus will now be given to it by the recent appointment of a sanitary engineer.

The Sanitary Board held two meetings during the year, and business was also conducted by the circulation of papers. Their attention was devoted to the measures cited above for the encouragement of improvements in village sanitation and to questions arising out of the vital statistics of certain towns which have been supplied with drainage systems and waterworks, and where, *primâ facie*, improvement in the public health has not been exhibited; but the premises on which this assumption was based were shown to be partial or misleading.

Central Provinces.—The total income of the municipalities in the Central Provinces for the year 1899-1900 was £71,357, or £4,094 more than in the previous year. Of this total it is said that 28·18 per cent. was spent on "original and recurring sanitary works," but details are not given for the separate heads. So far as can be judged this is about 10 per cent. less than in the previous year, and this is scarcely matter for surprise in view of terrible famine through which the province passed, and which must have involved heavy calls on the resources of local bodies.

The chief sanitary works undertaken were in connexion with the extension, maintenance, or completion of the water-supply projects for the following towns, Khandwa, Burhanpur, Harda, Nagpur and Wardha. A considerable extension was effected in the drainage system of Jubbulpore City, and beyond this a long list is given of minor works carried out by the municipalities chiefly in connexion with the improvement, amplification and conservancy of water-supply sources, a question of the gravest and most urgent importance in view of the great drought that prevailed; a good deal of this work was done by famine labour.

As regards rural areas, a summary is given of the notes submitted by Deputy Commissioners on the working of the Village Sanitation Act, which is by no means generally in force, and the results of which, in the year under review, were not so favourable in all cases as might be hoped owing to the prevalence of famine. Progress in this direction must be slow, but with the return of prosperity there is justification for the hope of better things.

The Sanitary Commissioner observes that "owing to the adverse condition of the province no meetings of the Sanitary Board were held during the year. In several districts the work of sanitary reform was, on account of the general distress and consequent paucity of funds, much curtailed, while in some others it was brought to a standstill." However, a good many minor works, chiefly for the improvement of water-supply sources, were carried out under the Board's direction.

Berar.—The estimated income of the municipalities in Berar in 1899-1900 was £19,019, or £904 more than in the previous year. The total expenditure, under all heads, on sanitary measures, was £8,483, or 44·6 per cent. of income, against 48·4 per cent. in the previous year; this decrease, which is shared by each head of expenditure, being attributed to the large extra charges involved in combating famine and epidemic diseases. Outside the municipalities a total sum of £7,194 was expended by district boards chiefly on drainage (£255), water-supply (£4,125) and "domestic cleansing" (£2,794), sums fairly equivalent to those devoted to the same purposes in the previous year excepting that on drainage, which shows a considerable fall.

The District Sanitary Board met once at each headquarter station during the year to take stock of what had been done on the suggestions made by Sanitary Commissioner in his survey notes on the several towns and villages inspected in past years. A large amount of work devolved on the medical and sanitary executive in the supervision and control of famine relief camps, and it was only to be expected that village sanitation should receive less attention than usual.

Madras.—Excluding the Presidency town, the estimated income of the 60 municipal towns in Madras for the first nine months of the fiscal year was £191,537, as compared with £199,841 in the similar period of the previous year. A sum of £116,053 was allotted for all sanitary purposes, and the aggregate actual expenditure up to the end of December, 1900, was £78,490, against £60,904 in the corresponding period of 1899. The relative distribution of these sums in the two years may be seen by a glance at the subjoined statement, which also gives the figures for the city of Madras for comparison :—

Heads of Expenditure.	Sixty Towns. Population=1,720,202.		Madras City. Population=438,375.	
	1899.	1900.	1899.	1900.
	£	£	£	£
Conservancy	32,652	34,987	22,599	1,761
Improvement of village sites	11,632	12,815	4,618	6,537
Water-supply	13,082	27,063	2,818	1,453
Sanitation of fairs	503	455	—	—
Markets and slaughter-houses	969	792	5,022	4,596
Other miscellaneous sanitary works	2,066	2,379	4,656	44,693
Total	60,904	78,491	39,713	59,040
Income	233,208	191,537	96,501	106,183

Very considerable differences will be noticed in the expenditure under water-supply in the 60 towns and under miscellaneous works in the city, which account for the large aggregate increase in each case during the year under review, but the Sanitary Commissioner affords no clue to the cause of the contrasts exhibited. He reports what was said last year that the necessity for retaining a reserve for the emergency of plague, and in certain cases the incurring of increased expenditure on account of threatened or actual invasion has so tied up or crippled the resources of local bodies that these have been unable to undertake any sanitary works of importance.

The actual achievement in this respect and the different works in various stages of consideration are set forth in the report of Sanitary Engineer. The programme for the year embraced schemes for the water-supply of Berhampur, Negapatam, Tiruvannamalai and Calicut, and for the drainage of Madura. The projects for the first and third named towns were worked out, completed, and submitted to Government, and the others are still in various stages of progress. But beyond these, plans and estimates were drawn up for schemes of water-supply to Chidambaram, Tuticorin, Madura (extension), Trichinopoly and Masulipatam, and for the drainage of Ootacamund. The construction of infiltration galleries in connexion with both the Trichinopoly and Cuddapah waterworks was completed during the year. Of the 60 municipalities, 38 have been surveyed for water-supply schemes and 25 for drainage projects, and as regards 12 in the former category, schemes have either been completed or are in active progress, and some 17 more schemes are under consideration or in abeyance ; while as regards drainage four schemes have been completed or are in progress, and in five cases they are still under consideration or in abeyance. The report affords very full and interesting particulars regarding each town or area which comes into the above statement.

The sanitary works carried out by the local (district) boards during the year consisted in sinking and repairing wells, construction and repair of tanks, latrines, markets, slaughter-houses, &c., and the improvement of village sites. The aggregate estimated income of these district boards amounted to £801,338 against £574,323 in the previous year. Of the former sum £42,424 or Rs. 5·2 per cent. was set apart for sanitation purposes, but little more than half of this was actually spent ; in only four districts was the allotment fairly worked up to. Thus in spite of a very large increase in the resources the sum spent was less than that so devoted in the previous two years, but the necessity of retaining resources in hand for possible or actual plague measures has been the cause

of this lack of enterprise. And thus, although the fear of plague has been the beginning of wisdom as regards sanitary effort in many other parts of India, it is to be feared that Madras has lost ground in the general campaign against dirt and disease even if it has succeeded, in large measure, in keeping plague itself at bay.

There are, however, abundant signs that the sanitary executive is fully alive to its duties and responsibilities; 237 reports of sanitary inspections of towns and villages were received during the year from district, medical and sanitary officers, and it is certainly not from lack of the best scientific and practical advice of which the Sanitary Commissioner's report is witness, that local authorities are at any disadvantage.

The Sanitary Board scrutinised and advised on plans, estimates, &c., for works for a very large number of municipalities, district and taluka boards, and type plans for rural hospitals were drawn up and issued.

Coorg.—No particulars of municipal income are given in the advance proof of the report which alone is available at the time of going to press, but it is said that the sum of £18 was expended by the Public Works Department, and £44 by the various municipalities on sanitary works during the year.

It is also stated that the Sanitary Board held four meetings during the year at which plague preventive measures and some minor matters were discussed.

Bombay.—During the year 1900 there were 165 municipalities in the Bombay Presidency, excluding the capital city, with an aggregate population of 2,196,359 souls; the total income, including opening balances, amounted to £459,667, against £368,446 in the previous fiscal year. Of this sum £97,180 was expended under the three chief heads of water-supply, drainage and conservancy, which is about 21 per cent. of income or a little less than the allotment for the previous year. No details are given of the expenditure incurred under "other sanitary works," "markets and slaughter-houses," "town sites," &c., which in the previous year involved an outlay of some $8\frac{1}{2}$ lakhs, but it is presumed that these responsibilities were not neglected.

The entire income of the 23 District Boards, including 205 Taluka Local Boards amounted to £302,862, out of which £21,497 were expended on the three main heads of sanitary works, a sum approximately equal to that so spent in the previous year.

The Village Sanitation Act (1889) has been introduced into 301 villages, or one more than in 1899. It would appear that owing to plague and famine, which has absorbed the attention of district officers, no progress has been made in the establishment of village committees under the Act, and better times must be awaited. The same must be said as to the number of selected villages into which the sanitary inspection note-book has been introduced, though there is evidence of the greater use to which these records have been put.

The more important sanitary works undertaken during the year are alluded to in the report of the Sanitary Board, which opens with the remark that plague and famine pressed hard on the municipalities during the year, though Government gave considerable grants-in-aid for plague expenditure to many of these local bodies.

The waterworks at Sukkur and Hyderabad were supplemented by additions to the machinery, and plans and estimates were prepared for extending the filtering area of the latter works. Plans for the Kaira and Mehmadabad water-supply schemes have been prepared, while that for Poona is now before Government. Of the Yeola works it is reported that they have been at a standstill for over two years, the municipality being unable or unwilling to provide funds.

The water-supply project for the town and cantonments of Belgaum has been transferred to the Madras military authorities for disposal.

The Ahmedabad drainage scheme which was shelved for more than a year has lately been taken up, but the prospect of progress is not good as the Executive Engineer has not time to devote proper attention to it, and a special Sanitary Engineer, who can give his whole time to the work, is considered essential. The great Poona sewage scheme which comprises the bacterial purification of the sewage and the utilization of the effluent for crop-irrigation has now assumed definite, if not altogether final, shape; the plans and estimates have been submitted to Government, but it is said that neither for the sewage nor for the water-supply scheme is there much hope of realization without a liberal loan from the Imperial authorities.

Finally, the Board advert to their previously expressed opinion as to the advisability of their being endowed with executive as well as consultative powers, to enable them to initiate and supervise sanitary works. They also point to the serious drawback to

progress involved in the multifarious duties which occupy Executive Engineers, who have no time to give proper attention to large sanitary works. It must be admitted that these considerations are well worthy of the attention of the authorities.

Burma.—The number of municipal towns, 41, remained the same. Their total income, including opening balances, was £274,178, against £389,576 in the previous year. Altogether 55 per cent. of income was spent on sanitary works; 9 per cent. on drainage, 11 per cent. on water-supply, 14 per cent. on conservancy and 21 per cent. on miscellaneous "other sanitary works"; in the previous year only 34 per cent. was thus expended in the aggregate.

Prome was the only municipal town where anything appreciable was expended on water-supply or drainage. The laying-on of the river water, though unfiltered, has proved of great advantage to the public health, and a system of drainage is in active progress. Schemes for the extension and improvement of the water-supply at Mandalay and Rangoon are under consideration; it is said that the latter, to cost 11 lakhs, is to be taken in hand without further delay.

Various other projects for which surveys and plans have been completed, are under consideration; *e.g.*, an artesian well for Paungdé; water-supply schemes for Moulmein and Meiktila, while the drainage scheme for the latter has been completed.

On rural sanitation a sum of £10,397 was expended from District Cess Funds, 12 per cent of which was on the water-supplies, 28 per cent. on drainage works, 25 per cent. on domestic cleansing, and 35 per cent. on miscellaneous works.

While much actual achievement has not marked the year under review in regard to large sanitary works in either urban or rural areas, there is evidence of awakening on the part of the responsible authorities, and the next few years should see many useful and important projects completed, while the task of educating the backward population of the rural tracts is not being neglected.

Of the Sanitary Board it is said that proposals for its reorganization were submitted to Government during the year, but these proposals are not given in the report.

General Remarks.

The outlook, past and future.—The century which has just closed, and with the last year of which this report deals, has witnessed great progress in the sphere of preventive medicine in India.

The subject is a fascinating one, whether regarded as in great measure the harvest of the work of one man, Parkes, who laid the foundations of the Netley School of Hygiene and whose inspiration has descended upon successive bands of students unto the present day, or, in its larger aspect, as an important contribution to State economics. But a recital of the achievements of the medical services in this country in the control of sickness and mortality among the British and native troops and the jail population, to which classes of the people alone sanitary measures can be adequately applied in the present stage of public opinion, deserves a separate essay for its adequate presentment rather than a concluding paragraph in this report, the authorised limits of which have been reached. A statement of the kind indicated is, however, projected, and will, it is hoped, appear before long in another place. Here, in the fewest words, it may be stated that for the quinquennial period, 1861–65, the average annual ratio per 1,000 of strength of admissions to hospital (all causes) among British troops in India was 1,636·3, while the death-rate was 26·95; whereas for the five years just concluded (1896–1900) the figures are 1,328·6 and 16·52 per 1,000 respectively; in 1899 the admission-rate was 1,148 and the death-rate 12·75, while in 1900 the former rate was 1,143 and the latter 14·62 per 1,000. And this large saving in life, which is equal to a British regiment per annum, has been effected in spite of the changes in the *personnel* from the older long-service men to the younger and less-developed components of the present army, who furnish the largest proportion of sickness and mortality.

Going further back we find it stated on good authority* that the average annual death-rate per 1,000 of European soldiers in India was 84·6 for the period 1800–30, and that it was 56·7 for the period 1831–56, against the present average rate of 16.

* Professor J. Lane Notter, quoted in "Indian Lancet," 16th June, 1896.

The official records of sickness and mortality among the native troops which are immediately available extend over the last 21 years; in the first quinquennium embraced by this period (1879–1883) the average ratio per 1,000 of strength of admissions to hospital (all causes) was 1,336·2, and the average annual death-rate was 23·95, whereas for the period 1896–1900 the ratios are 781·4 and 11·81 respectively, showing an enormous saving in valuable lives and in effectiveness for service; but the comparison is to some extent vitiated by the effects of the Afghan campaign which occurred in the former period, though it is to be noted that the Tirah and other frontier campaigns (1896–98) come into the latter period. In the quinquennium, 1899–93, the annual average admissions ratio was 1,013·3 and the death-rate 13·92. Lastly, as regards the jail population, it will suffice to quote the figures for three periods for which authentic records are available. During the first, extending from 1832–33 to 1854* (about 21 years) the average annual ratio per 1,000 of admissions to hospital (all causes) was 1,230·2, and the death-rate on the same basis was 70·7; next, taking the first and last quinquennial periods of the last 21 years (1879-1900) we find that for the former the ratios are for sickness 1,194·6 and for mortality 48·86, while for the concluding period they are 980·7 and 29·97 per 1,000 respectively. This last period coincides with the widespread prevalence of famine and scarcity and the consequent excess of epidemic disease among the general population, conditions which drove large numbers of the destitute to crime and flooded the jails to overcrowding, by the dregs of the population, who, never robust, were often in the last stages of disease.

The above facts may be better appreciated if stated in tabular form thus, referring to the mortality ratios only:—

Death-rates per 1,000 *of strength.*

—	1800–30.	1831–56.	1861–65.	1869–78.	1896–1900.	1879–83.	1896–1900.	1833–54.	1879–83.	1896–1900.
European troops	84·6	56·7	26·95	19·3	16·52	—	—	—	—	—
Native troops ...	—	—	—	—	—	23·95	11·81	—	—	—
Jail population	—	—	—	—	—	—	—	70·7	48·86	29·97

This record, remarkable as it must be accounted, is but the earnest of further progress, standing as we do at the opening of a new area in the study of the etiology of tropical disease. The new departure evidenced by the establishment of the schools in London and Liverpool, together with the development of the best methods of pathological research at Netley, has been reflected in the general spirit of enquiry that animates the medical services in India more markedly than ever to-day and which affords ample promise that the high traditions of the past will be maintained. These traditions may be to some extent appraised by the fact that during the past century at least 15 officers of the Bengal service have received the high distinction of the fellowship of the Royal Society, the year 1901 being signalised by two such awards. It is true that the ordinary executive duties of medical officers have for the majority been too engrossing or too distracting (from the constant changes due to the exigencies of the service) to permit of the steady concentration of effort which research work demands. This disability the new bacteriological department will largely remove, and while scope and opportunity for the elucidation of the problems of disease will be afforded to the select few best qualified for the work, an impetus will be given to similar efforts throughout the service. Officers know that the official seal of approval has been set upon the work and that there is a career open to them in the special department if their tastes and talents qualify them for it. The record of the past year affords abundant and gratifying evidence of this, as will appear in the subsequent remarks.

When we come to survey the progress made in the amelioration of the health conditions of the general population, we are met by grave difficulties, with the nature of which those who have followed the facts set forth year by year in the section on vital statistics in this volume, will be familiar (see also the remarks on page 69). The registration

* "Indian Annals of Medical Science," October and April, 1856, and the Report on the Sanitary condition of the Madras Jails, 1856.

of vital phenomena is everywhere, but in varying degree, gravely defective, and as it tends to improve, as is undoubtedly and markedly the case, the mere records do not afford much ground for congratulation, for a higher death-rate may not, often does not, connote a greater proportional mortality. In previous sections of this report some of the main outstanding conditions of life of the people have been alluded to, and many of these are beyond the influence of sanitary effort save that which is embodied in precept and example, which is alien to their sympathies and traditions. The gigantic problem of providing a sanitary environment for the masses who dwell in towns and villages which have grown up without regard to sanitary principles, is one which has long exercised the wit and resources of the authorities, and it can truly be said of the effort that "it moves." In the matters of water-supply and conservancy much has been done; we are encroaching steadily and persistently on the realm of dirt, and we are undermining the apathy and ignorance that beget it. Still this is from the outside, and the homes of the people, which have, for the most part, defied our efforts, present conditions that call for reform, especially in the towns, where overcrowding on the site and in individual dwellings, and the absence of due provision for ventilation favour all the factors that go to make an insanitary environment.

The people, while generally scrupulous in the performance of the rites of which the daily life is one long procession, and which are often based on fundamental principles of personal hygiene, have no notion of *public* health, and very little of corporate effort; each man, in this respect, is a law unto himself and provided he escape defilement the law is well observed. Moreover, the large number of natives who have been trained in medicine and in the elements of hygiene exercise very little influence on their fellows; they rarely lose their own inherited prejudices, and consequently fail to proselytise to their merely formal faith. Our efforts in the sphere of clinical medicine and surgery are appreciated and yet, to a large extent, still suspect and only appealed to as a last resource; they appeal to the people as something occult, ultra-rational and capricious, and as exacting no obligation to defer to the doctor's preventive ordinances.

The provisions of any legal code can only be effectually realized in so far as they represent the conscientious convictions of those to whom they apply; they will be null and void in proportion as they are in advance of, or behind, the stage of opinion reached by the majority. The experience of the results of endeavouring to apply reasonable (to our notions) preventive measures in the campaign against the plague is a case in point; the contrast in the attitude of the people in Glasgow and in Bombay is very suggestive of our limitations in this country, and one of the outstanding mysteries of our policy in regard to plague in the eyes of intelligent foreigners is the fact that the epidemic is treated rather as a political emergency than a matter of public health. It is satisfactory to find that many inclined to scoff at this attitude end by appreciating the necessity for it;* but all this is by way of explaining why Municipal and Village Sanitation Acts fall short in practice of the effects they are intended to realize, why even their simple provisions cannot be rigidly enforced, even if we could trust the native agents to whom the duty nominally falls. At the same time much can be achieved by patience and persuasion as in the case of vaccination against small-pox; here the relation of cause and effect is much more simple, direct and obvious, than the relation which dirt and overcrowding bear to plague, for "dirt and overcrowding" are terms which bear a different connotation in the minds of the people to that we attach thereto. Where we can appeal to their reasoning faculties and instincts they follow, as in the matters of vaccination and of the evacuation of plague infected sites; and herein lies the hope for the future, our practical efforts being directed to the extension of education on the one side, and of the sanitary organization on the other and so to the fostering of co-operation, while at the same time we press on with all those general measures of public health that properly belong to the sphere of the State and its local representatives.

Active measures have hitherto necessarily been for the most part of the nature of a compromise with physical conditions already long established, as well as with ingrained prejudices. The native quarters of the larger towns and of the capital cities have grown without regard to hygienic considerations into the similitude of huge irregular honeycombs. The outbreak of plague has brought this state of things home to the authorities of some of the largest cities, and they are now grappling with gigantic schemes involving the provision of more space, which means more light, more air, and a purer soil, in the

* *See* "Ueber einige Beobachtungen während der diesjährigen Pestepidemie in Bombay, von Dr. Martin Hahn; an address before the Berlin Medical Society, 26th June, 1901.

more densely crowded parts of the inhabited sites. The nature of the problem thus presented may be, to some extent, appraised by the case of Calcutta ; at the census of 1891 the density of the population in the town wards was at the rate of 116 per acre, but in 1901, in spite of a natural decrease (excess of births over deaths) during the decade of some 125,000 souls, the large influx of immigrants, estimated at 270,130 persons, has increased the pressure of the population on the inhabited site to the average rate of 145 per acre.* With the growing tendency to industrial development, the steady and rapid growth of town populations must be anticipated and a great responsibility rests upon local authorities to provide for this by the rigorous enforcement of building laws to prevent the gravest evils to the public health, viz., space overcrowding and defective ventilation. With the rapid development of railways and the consequent establishment of new centres of population, the responsibility for preventive measures in this respect is equally great, and in this case the task should not be insuperable. The problem is one which now affects fully one-tenth of the huge population of the Dependency, and this proportion is likely to be rapidly increased in the near future ; and its gravity is enhanced by the consideration that all measures of public health largely depend for their success on its solution.

Meanwhile, as regards the mitigation of the chief cause of sickness and mortality to which this vast population is subject, the future is bright with promise. The idea of banishing malarial fevers entirely from the list of ills in this country is magnificent, and it is impossible at this stage to forecast how nearly that consummation might be achieved if the interest and intelligence of the people could be enlisted in the campaign, but it need scarcely be said that the practical problem is altogether on a different scale to that presented in Italy where the State is taking vigorous action in pursuit of the policy indicated by the new researches. Here indeed it may be said that the harvest is great and the labourers comparatively few, and, for a considerable time, efforts will have to be concentrated on the more populous and enlightened centres, on cantonments, and on the jails and their surroundings. No apprehensions need be entertained for the present of the embarrassing effects of the general success of these efforts on the natural increase of the population, though this aspect of the question has more than a merely speculative and academic interest. The transformation brought about in the Western Doab districts of the North-Western Provinces by large drainage operations has been described and yet malarial fevers have certainly not been banished from this area, and could we look forward to this achievement the contest of man with his environment would doubtless in the long run result in the same issue ; prosperity and a high birth-rate induce overcrowding and the natural check to increase in one or other form of disease. Malarial disease must be said to be the direct cause of at least one-third of the total mortality all over India, and of a far larger proportion of the total morbidity, and if we could anticipate its elimination, the normal natural increase of population, which may be put at an average of 10 per cent. in the decade, would rise to nearly 25 per cent., and this without taking account of the increased fecundity of the people which malarial disease so markedly impairs.

Before proceeding to a brief review of the work accomplished during the year under the inspiration of the new researches, the lesson of the results of large drainage operations may well be emphasized, especially in view of the desirability of extending irrigation works in tracts where the rainfall is scanty and capricious, and at a time when the railway construction programme is being vigorously pursued ; skilful alignment and adequate drainage are inalienable responsibilities accompanying such public works. For, if from any cause, natural (as by floods and the silting up of river beds) or artificial, the ground water level is permanently raised to within a few feet of the surface, and if water-logging of the soil is induced, the evidence is now undeniable of the deleterious effect on the population, the cattle, the soil, and the water-supply ; while, on the other hand, these conditions being established no sanitary works can vie in efficacy with those adopted to reduce the water level. The evidence afforded as to the transformation effected in the Western Doab is only a repetition of similar testimony previously furnished as regards the area irrigated by the Western Jumna canal†. Water is an indispensable servant but an inexorable master in a tropical country.

Progress in the differentiation of Indian fevers.—In last year's report a résumé of the work accomplished on the formidable task of differentiating the various forms of febrile

---

* In many of the wards it is much higher, and in Bombay city the average in 12 of the wards amounts to no less than 458 persons per acre.

† *See* Dyson, Trans. Ind. Med. Congress, Calcutta, 1894.

disease which have long been a reproach to our nosology was given, and that statement may be supplemented by the remark that the evidence since forthcoming has demonstrated the wide distribution of Malta fever, which may be said to have been found wherever carefully looked for; it has been found in the wilds of the Swat Valley, on the Himalayas at a height of over 7,000 feet above sea level, and in the crowded low-lying cities of Bombay and Calcutta. Similarly, Cerebro-spinal Meningitis and Typhoid fever have been found to have a far more general incidence on the natives of, at any rate, the more populous centres than has hitherto been recognized.

In at least one large centre, Bombay, the practical bearing of a careful discrimination between the various fevers is being realised. Systematic efforts are being made, under the direction of the Health Officer, to mark down the specific nature of all the anomalous fevers that have been classed as "remittents." A great deal of valuable work is being carried out in the separate wards of the city by the Divisional Health Officers, and the microscope and the serum sedimentation tube are being enlisted in the cause of preventive medicine by these busy executive officers, with the result of indicating special foci of disease which raise the general death-rates in large wards.

It is to work of this kind at the hands of medical officers of regiments and of jails that we must look for the all-important and pressing obligation of purging our nosology of obsolete and meaningless terms and for obtaining a scientific survey of the field of Indian febrile disease. No case of fever should henceforth be returned without an attempt at accurate diagnosis; the reform of the nomenclature will necessarily follow, and the all-embracing bane "Ague" will disappear from the records; a diagnosis of ague in an untreated case of fever, without the identification of the parasite, must be held to connote incompetence on the part of the responsible medical officer.

Researches on malarial fevers.—And it is chiefly in respect of the various problems connected with the causation and distribution of ordinary malarial fevers that the work of the year demands notice. The arrival of two Commissioners, Drs. Stephens and Christophers, delegated by the Royal Society to pursue researches into this subject, and especially as regards prevalence of "Black-water fever," afforded the Government of India an opportunity of associating with these gentlemen Captain S. P. James, I.M.S., who had already distinguished himself by his observations in Southern India. The main objects of the Commission's work have been the study of the problems of malarial disease as presented in different districts among the general population, and further, an enquiry into the best practical means of reducing and preventing the incidence of the disease on the inhabitants of cantonments and jails, where the conditions are more easily attacked and controlled. Up to the time of going to press with this report, the town of Calcutta, four districts in Lower Bengal, four districts in the "Duars" (Darjeeling-Tarai), the hill station of Kurseong (5,500 feet elevation) and the cantonment of Mian Mir on the Punjab plains have been visited and surveyed from this point of view.* The routine work has comprised the examination of specimens of blood from large numbers of children and adults of the general population; the dissection of a large number of *Anopheles* mosquitos to ascertain the percentage of infection; a study of the various species of *Anopheles* present in different districts, and the investigation of their habits and breeding places; an examination of cases of malaria under treatment in hospitals; and, lastly in Mian Mir, practical experiments in prophylaxis. Premising that true "endemicity" may be determined by the proportion of children and of *Anopheles* found to be infected (the "endemic index"), it has been found that what is true for Africa in regard to the infection of children and the relative non-infection of adults in malarious places, is true for India. The amount of the infection of children is a reliable index of the general prevalence of malaria. The endemic index was found to range from *nil* in Calcutta to 43, 55, and 72 in the "Duars." The Calcutta districts chosen were those in which all the conditions usually associated with the development of malaria were present, including *Anopheles* in abundance. It is remarkable that not one of the 140 children examined had parasites in their blood, and that not one of the 342 *Anopheles* dissected was infected. In the height of the "fever" season (September) 42 more children were examined with the same results—no parasites and no enlarged spleens. The results of the examination of patients in the hospitals were practically the same, and parasites were only found during relapses in two cases of a chronic type. There are indications that such ordinary malarial infection as occurs in Calcutta is derived from outside the city, and that the risk of contracting the usual forms of the disease therein is remote. But the Commissioners are careful to

* These facts are taken from a preliminary report by Captain James, I.M.S.; the reports of the Commissioners will be published by the Royal Society.

distinguish between malarial disease accompanied by parasites in the peripheral blood, and a form where this diagnostic evidence is wanting. The latter appears to be common in Calcutta, and is of grave type which passes into a true malarial cachexia, the main indication presented by a microscopic examination of the blood being a large increase in the mononuclear leucocytes, a fact to which attention has been drawn by a French Army Surgeon in Algeria.

Proceeding from Calcutta, a definitely increasing endemic index was found as the investigation was pursued across the plains to the Terai country at the foot of the hills, until at Nagrakata parasites were found in the blood of 72 per cent. of the children examined. It is suggested that these marked contrasts might be due either to differences in the actual number of *Anopheles* present, or to differences in the species of *Anopheles* in different places. It is certainly demonstrated that the actual number of *Anopheles* present is no criterion of the prevalence of malaria ; in Calcutta they swarm, and there was, it is said, no obvious evidence of malarial infection (parasites in the peripheral circulation), while in the Duars where the endemic index is very high it was often difficult to capture a specimen of *Anopheles*. This brings out the all-important question as to the particular species of *Anopheles*, one or more, to which the reproach attaches. The Commissioners have themselves met with 20 different species in India,* and this cannot be said to exhaust the list, and they conclude that certainly all cannot be regarded as equally implicated ; and as regards *A. Rosii* evidence is detailed that goes far to show that this very prevalent species is hostile to or immune from the parasite.

The question of the value of the symptom of enlarged spleen as an index of the prevalence of malaria was also examined, and it is concluded that only among children is a relation established (and that not definite) between the "spleen rate" and the "parasite rate" ; it is said that the percentage of children with enlarged spleens in any place gives a fair indication for purposes of comparison, and in the absence of blood examinations, of the prevalence of malaria and the liability to infection.

The Commissioners are now pursuing the study of the practical problems of prophylaxis in the cantonment of Mian Mir, one of the most notoriously unhealthy places in India. The breeding places of *Anopheles* are being marked down, and (the soil is dry, sandy, and porous, and not subject to the retention of surface collections of water) these have been traced to irrigation channels, wells, "tanks" and small receptacles (tins, &c.) near dwellings. Six species of *Anopheles*, two of which are newly identified, have been detected in their transition-stages in the environment and in their adult stage in the occupied houses. The problem of exterminating the former in the long irrigation channels is a serious one, but hope is entertained that by cutting the banks to a smooth inclined surface, by the removal of weeds and sheltering inequalities, and so promoting the velocity of the current, a large measure of success will be attained, and experiments are to be made to test this. Among the children in the bazaars, 30 to 50 per cent. of those examined were found to harbour parasites, and the "spleen rate" was from 70 to 90 per cent. We have then in this cantonment the two essential conditions of endemicity, viz., high percentages of children and of *Anopheles* infected with the specific parasite, and it is not therefore surprising that the troops should suffer grievously from malarial disease. Work on the lines indicated will be pursued in other cantonments.

One of the results of the Commission's labours is to demonstrate that Black-water fever is far more prevalent in India than has hitherto been supposed, but details are held over for publication later.

In connexion with the experiences of the Commissioners as regards the prevalance of true malarial fevers in Calcutta, the observations of Captain Rogers, Indian Medical Service, as set forth in the October number of the "Journal of Hygiene," are of interest. Briefly, he exhibits by means of a graphic chart the divergence—the contrast—between the maximum seasonal prevalence of *Anopheles* in "tanks" and of malarial fevers as manifested by the hospital returns, and further he shows that the fever curve always rises with each "break" of a week or more in the monsoon precipitation, and that the specially unhealthy years are those in which such breaks are most frequent, quite irrespective of the total amount of the rainfall. These breaks are effectual in drying up a very large proportion of the smaller pools and so in diminishing the number of larvæ to be found.

The importance of "tanks" (ponds and lakes) as breeding-places of *Anopheles* is emphasized in view of some earlier authoritative pronouncements to the contrary, and the

---

* It may be mentioned that two species, not previously described as occurring in India, were found to be prevalent in the Duars, viz., *A. funestus* and *A. costalis*, the two species which convey malarial infection in tropical Africa.

fact is of practical moment from the enormous numbers and large extent of these tanks in many parts of the country, for it obviously enhances the difficulties in the way of effective measures of prevention. With the exception of this remarkable prevalence of the larvæ in the tanks during the hot weather (season of minimal fever prevalence) the facts set forth show that the seasonal distribution of these mosquitos in small collections of water, pools, drains, &c., and of malarial fevers, respectively, coincides generally, and are in accordance with recent observations in other parts of India. With the knowledge that *A. Rossii* is the most generally prevalent species in Calcutta, and that there is good evidence for absolving it of any part in the harboring and transmission of the parasite the apparent anomaly disclosed in these observations presents less difficulty than would *primâ facie* appear. Captain Rogers has many pertinent suggestions to offer upon the facts disclosed by his enquiry, and his paper is a valuable contribution to the study of the problem of prophylaxis, while incidentally he discloses the enormous difficulties in the way of the successful application of certain methods that elsewhere appear to afford the best hope of success.

Another example of admirable work is the detailed description of a year's experience of the habits of *Anopheles* in Ellichpur, a cantonment in the northern part of the Deccan* by Captain Glen Liston, Indian Medical Service.

This touches an altogether different side of the subject, while not neglecting the more direct and obvious connexion between the seasonable prevalance of the incriminated insect and that of the disease, for, as the author remarks, it is evident that the habits of *Anopheles* vary in different countries and in different parts of the same country, where the area is so vast as that of India.

Following an account of the seasonal incidence of malarial disease among the troops, the cases being verified by blood examinations, we get a description of the breeding-places of *Anopheles* at different seasons of the year, important variations in the distribution of the larvæ being shown to occur under the varying conditions of the environment. This is supplemented by a series of interesting experimental observations on the eggs, larvæ and pupæ, which serve to elucidate the life-history of these different developmental stages and the conditions favourable or inimical thereto. Lastly, a closely detailed description of the several species of *Anopheles* hitherto found in the area surveyed during the year is given, and illustrated by excellent reproductions of photographs taken from water-colour drawings. On the main facts of the epidemiology Captain Liston's observations are in accord with those already fairly established; the maximum fever incidence coincides with the maximum prevalance of *Anophèles*. The breeding-places may be said to altogether disappear in the hot dry weather; the adult insects, however, survive in large numbers in the Deccan climate until the rains set in, and thereafter a new generation spreads over the country, one collection of water after another becoming infected, this being the period of most general human infection.

To complete this sketch of the work now being prosecuted in different parts of India, a brief reference may be made to the labours of Major A. Buchanan, I.M.S., who is in charge of the Central Jail, Nagpur, and who has recently published an elaborate essay on "Malarial fevers and malarial parasites in India," the result of his enthusiastic application to the subject during the past few years. This is a notable contribution to the literature of the subject based on actual daily observations over a prolonged period, and it affords a comprehensive and stimulating record of observations and experiments on the facts and problems as they present themselves to an acute and resourceful worker who is at the same time a skilful clinician. A remarkable note is struck at the outset, in the acknowledgment made by the author of the capable assistance rendered in these researches by several of his Burmese prisoners, whom he trained to the use of the microscope and who soon became expert in detecting and distinguishing the various kinds of parasites. This is a significant episode affording a gratifying prospect of the multiplication of skilled observers which cannot fail to influence in a marked degree the future progress of the task before us. It is difficult, in the space at command, to summarise even the outstanding features of this suggestive book, which throughout bears the impress of honest work and personal experience guided by imaginative insight. Besides a systematic clinical account of the different forms of fever and the associated parasites, which is the first attempt of the kind in India, there are most interesting and suggestive sections devoted to various special practical aspects of the subject: notably an account of the results of experiments on the action of quinine and arsenic in quartan fever

* *See* "Indian Medical Gazette," October and December, 1901.

and to determine the prophylactic dose of quinine in each variety of fever; a summary of the facts showing the relation of the seasonal prevalence of *Anopheles* to the incidence of attacks; experiments exhibiting the protective effects of mosquito curtains; inoculation experiments; researches on the blood-parasites of birds; an exposition of the clinical facts and appearances in what the author designates "Flagella fever," and many other points, which well repay study, and the book is altogher one that no worker on the subject can afford to neglect.

Space does not permit of a notice of several interesting inoculation experiments, notably those conducted by Captain Fearnside, I.M.S., on himself and on a warder in the Rajahmundry Jail, and those carried out by Major Buchanan, I.M.S., at Nagpur, and described in the book to which reference has been made. Nor can we pause to notice the many attempts now being made by health officers and others to pursue the methods of prophylaxis indicated; these efforts are necessarily in the tentative stage, but so far, and especially where carried out in connexion with small communities and institutions, they are giving promise of gratifying success.

It will, it is thought, be seen from the above brief sketch, and from what follows, that active work is being prosecuted in many different directions of the field of malarial research. As the increasing band of workers gets into closer touch with the varied aspects of the subject, the lines along which enquiry may best be directed become more definitely indicated, and it may be useful to briefly summarise some of these, as they bear on the desirable end of obtaining a survey of endemic malarial disease in this country. The work of the Royal Society's Commissioners, alluded to, affords most useful suggestions, and it may be said that workers should endeavour—

I.—(*a*) to determine the "endemic index" (the parasite rate) together with the "spleen-rate" among native children; it would be well to classify the children examined, by age-periods, 0-5, 6-10, 11-15.

(*b*) In connexion with the above, the seasonal variation (of the endemic index), month by month, should be determined.

(*c*) With this, we need to know the distribution of the different species of parasites in place and season; *i.e.*, the percentage of each variety of parasite found in a particular series of blood examinations.

II.—In connexion with I (*a*) it is necessary to determine the local distribution of *Anopheles*, the percentage of each variety found, and the monthly variation in prevalence.

III.—The characters and distribution of the breeding places of each species of *Anopheles* is also a question of the first importance.

Of course the determination of the fact of infection or non-infection of different species of *Anopheles* (*II*) should be effected where possible.

The Nagpur Conference.—It was considered very desirable to hold a conference on the present position of the whole subject, at which active workers and those especially interested could exchange views on some of the practical problems. The proposal, which was originated by Colonel Scott Reid and Major A. Buchanan, I.M.S., received the approval of the Government of India, and medical officers serving in different provinces were encouraged to attend at Nagpur as the most central rendezvous, and where the work, which has long been in progress, affords special facilities for instruction and experiment.

The work engaged in was extremely practical, consisting of a series of lectures on, and demonstrations of, the well-established facts and of the more recent and unconfirmed observations of the experts, while experiments on new lines were also pursued. Altogeter this new and promising departure was characterised by a thoroughly practical spirit and a subordination of paper eloquence, that marks it off from the usual order of congresses, and that cannot fail to leave its mark on the history of the campaign in India, if only on account of the inspiration and instruction carried away by many officers to all parts of the country.

Among those present were some who have devoted themselves entirely to the scientific investigation of the more esoteric, as well as the comprehensive, aspects of the subject in West Africa and in India; others who have studied the parasites more exclusively in their clinicial forms; naturalists to whom the various species of *Anopheles* and their life-history have afforded an interesting field of study; and lastly, those, who as sanitarians, are chiefly interested in the practical questions of prophylaxis. All set to work to demonstrate practically their contributions to the common stock of knowledge with the result that a comprehensive survey of our present position was obtained. To Drs. Stephens and Christophers, especially, the other members of the Conference

acknowledged their indebtedness for the generous way in which they devoted themselves to the demonstration of the more difficult and abstruse phases of the development of the parasite in the definitive host. The daily work in the laboratory was supplemented by a series of lectures of which the following deserve mention: Dr. Stephens on malarial fever without parasites in the peripheral circulation; Dr. Christophers on the relation of the species of *Anopheles* to malarial endemicity; Major Buchanan, I.M.S., on the malarial parasite in human blood, with lantern demonstrations of the different forms of the parasite, of *Anopheles* larvæ and clinical charts; another paper by the same officer on the so-called "Flagella fever," in which he showed that a secondary rise of temperature takes place in malignant Tertian fever, at the time when the crescentic parasites reach maturity, and when the ex-flagellating forms are found in the blood drawn from the patient. Captain Rogers, I.M.S., discussed the diagnostic value of examination of the blood with special reference to the varying proportions of leucocytes in different fevers. Captain Liston, I.M.S., and Mr. Aitken contributed papers on the classification of *Anopheles* and their natural history, while Captain Birdwood presented a lucid summary of the practical indications for prevention applicable to different communities in India, a question which engaged the Conference in an extremely useful discussion during which the most effectual practicable measures were formulated and embodied in resolutions for presentation to Government; and to these we shall allude immediately.

Lastly, some of the immediately pressing problems of the parasitology received attention. It was clearly enunciated that certain species of *Anopheles* may abound where malaria is not endemic, and that it is probable that certain species are not effective hosts to the parasite; moreover, the different species vary much in their life habits, and particularly in their choice of breeding places; all these points raise questions for study, as has been pointed out in a previous paragraph indicating the lines for further enquiry. Again, it was found that while, in the cold weather, the zygotes would not develop beyond a certain stage at the temperature of the air, development progressed to the stage of sporozoites when the infected mosquitos were kept in a higher temperature by means of an incubator. This throws a light on many failures in inoculation experiments, and has an interesting bearing on the seasonal prevalence of the disease.

Practical preventive measures.—In conclusion, a brief reference may be made to the general plan of campaign which we are now in a position to formulate, but which will, necessarily, require modification according to local social and physiographical conditions. It is of course obvious that surface collections of water cannot be abolished or "disinfected" where the population depends solely thereon for its water-supply, though even here much is possible in the way of conservancy by clearing the banks of tanks of weeds, &c., and, again, certain measures may be applied more successfully to a cantonment than to a crowded native city.

What can be done, and ought to be done forthwith, is to carry out test experiments in various places under different conditions, such as, indeed, are now in progress at Mian Mir and other places; there is, at least, no excuse for delay in applying preventive measures in all cantonments, civil stations, jails, &c., where the medical staff and the requisite labour is available.

Educational.—One of the first requirements is to propagate as widely as possible a knowledge of the simple facts of the etiology of malarial disease and of the rational prophylaxis based thereon. Much is being done in this way by the circulation of literature to medical officers, and of pamphlets to all municipal and district board authorities. A clear exposition of the whole case with adequate illustrations has been drawn up for the instruction of medical subordinates and others, at the instance of this office, by Captain James, I.M.S., and the Nagpur Conference has agreed upon the terms of leaflets for the guidance of different local authorities. The propaganda is being disseminated in ever-increasing measure by the precept and example of medical officers in many places. It is not too much to hope that the simple principles may be inculcated along with the elements of hygiene in all educational institutions, and that medical officers will train subordinates in the use of the microscope, and in the detection of the different forms of the parasite and of the effective host.

Sphere of the State and of its local representatives.—Allusion has been made to the enormous benefits of large public drainage works, and to the necessity that these should accompany all irrigation and railway works and public water-supply systems that affect deleteriously the natural ground-water level, and the surface and sub-soil drainage.

The extension of impermeable brick or stone-lined surface drains, with direct house connections, involving the total abolition of waste water catch-pits so common in the basements of dwellings, is an imperative call on the resources of all municipalities and local bodies and cantonment authorities. Such a measure will effect much more than the prevention or diminution of malarial fevers. Legislation must provide against the common practice of making excavations in the soil of the inhabited site for building purposes, brick and pottery and road-making, &c. Stagnant collections of

water in and near the site must, as far as possible, be removed by drainage and levelling up of inequalities in the site. Old disused wells must be covered in, and the area around those in use must be carefully drained to connect with the main drainage system; stand-pipes, where there is a public water-supply, must be similarly treated. The cultivation of rice should be prohibited within a mile of inhabited sites. All these measures are summed up in the obligation on the part of the public authority to prevent, by all means, the stagnation of water upon the surface and within the upper layers of the soil, and to this end the first step is to procure a detailed survey of the site to locate stagnant collections of water and the breeding-places of *Anopheles*, and to secure the best plans for preventive measures. Ordinary measures of surface conservancy, the removal of waste-matters and of excessive wild vegetation must of course receive attention.

Following the precepts and example of Major Ross in West Africa, special efforts may be directed to the conservancy of domestic premises by "mosquito brigades," where the circumstances permit of this.

In hospitals the segregation of the sick and the protection of other patients by the use of mosquito nets is called for; while in some epidemics of the malignant types of fever ("Kala Azar," &c.) larger measures of segregation may have a more extended application. Public institutions, barracks, and European dwellings should be located at a safe distance from native huts, servants' quarters, bazaars, &c. The prevention of overcrowding in the latter is a measure of importance.

The sphere of the prophylactic use of quinine at the instance of public authorities in this country has its limitations. Its value in jails and similar institutions is not now in doubt. Government has been at pains to put the drug at the disposal of the people in the form of five-grain packets, for each of which one pice (one farthing) is charged at the local post-offices. The demand has not been at all commensurate with, though to some extent proportionate to, the prevalence of fever; if the cost were not a bar to its more extended use, there is still a prejudice, steadily decreasing no doubt, against the use of European medicines, and they are generally only resorted to when native "simples" fail. It would be hopeless to expect the majority to take quinine as a preventive, even if pressed freely upon them. There is no sufficiently marked and prolonged season of absence of malarial infections in this country, as a general rule, when a fair prospect would offer itself of extirpating the parasite in the blood of its secondary host. The conditions are altogether different to those presented in comparatively small well-defined areas of infection, where the seasonal incidence is definite and restricted, as in Italy and some tropical islands.

It is, at any rate, a paramount inducement to marshal our forces and attack this particular evil that every step taken will improve the general health conditions of the people: general measures of drainage, and for the prevention of overcrowding on the site, as well as in the dwelling—more space, more light, more air, and a purer soil—are emphatically the cardinal desiderata which sanitarians have always striven for, and our efforts should now be reinforced and inspired by the hope of more immediate results in the diminution of the chief causes of sickness and mortality. In attacking malarial disease we shall at the same time undermine the causes of tubercular disease, of lung diseases generally, and of bowel complaints. The time has certainly arrived when it is incumbent on every local sanitary authority to utilize and develop its resources to this end.

Sewage disposal.—Another direction in which considerable activity has been displayed in India during the past year is in connection with the question of sewage disposal. In this report for 1898 the present methods and the main general conditions of the problem were set forth, and it was hoped that the experiments then referred to would soon have advanced to a position from which interesting and important indications could be derived, though final and definite conclusions could scarcely be anticipated. It is, however, impossible in the space at disposal to give a detailed account of the results of the experiments carried out in different parts of the country, but these prove conclusively that we have in the "biological" methods an important addition to our sanitary and economic resources. It is scarcely necessary to affirm that the terms of the problem vary in important ways from those that present themselves in England, and similarly they vary as regards the circumstances of the different communities to be served in this country. It has always been a cardinal principle of the sanitary authorities in India that, given the proper conditions, no method of disposal, quâ disposal, could vie with that known as the dry earth and "trenching system," often called the Indian system. But however theoretically perfect, the difficulties in the way of its adequate realization are, for the great majority of communities in this country, so great, if not insuperable, that we are bound to reconsider the whole question. That the assertion that the difficulties are often insuperable is not a mere *petitio principii*, that it rests on solid evidence, will be seen from facts recorded in the report referred to (that for 1898, page 272 *et seq.*), and in a paper on the subject contributed to the last number of the "Scientific Memoirs by Medical Officers of the Army of India"; and this first question acquires special importance from the fact that Professor Ramsay, of London, a member of the Royal Commission on sewage disposal, took occasion during his recent visit to India to deprecate publicly any departure from our present methods.

He says "there can be no doubt that the most advantageous method of disposing of sewage is not to mix it with water, but to return it at once to the soil." He points to the absence of water-supply house connections in Bombay, and from the smaller quantity of water to be removed, he infers "that a convenient and profitable dry system is easily possible," owing to the accessibility and abundance of land and to the presence in India of the caste of sweepers. But he is careful to add, "there may be difficulties which I do not know of; . . . all I wish to convey is that the disposal of solid sewage is much more profitable than that of diluted sewage, if it can be managed." To this it must be answered that there *are* difficulties (many of which have been set forth in the publications referred to above), and that beyond this the dictum that the dry system is "more profitable" must be demurred to. What we have to secure is the rapid and complete decomposition and resolution into the original component mineral and gaseous compounds, of dangerous excreta, without danger to the community previous to and during this process, while at the same time we have to utilize these products of decomposition to the fullest advantage. The circumstances under which the dry system has to be carried out in this country do not fulfil these obligations. Moreover, considerations derived from experience in England certainly do not apply at all generally in India, under the entirely different climatic and agricultural conditions. The fairly regular and equably distributed rainfall in the former provides the agriculturist with all the water he needs for the single or, at most, the double, crop he obtains in the year from one piece of land.

Additional water requires sub-soil drains, while in India irrigation is almost everywhere at one or other period of the year absolutely necessary, and owing to the heat and dryness of the atmosphere the water only penetrates a few inches below the surface. The application of dry sewage to dry land and its reduction by irrigation water is a slow and irregular process, even if the means employed of getting the sewage from the houses to the land were devoid of danger. A matured effluent prepared for direct assimilation by vegetable life is a great advance as regards both safety and economy where the land is cropped so frequently; not only is final resolution more rapidly attained, and thereby danger avoided, but the outturn realised in produce is far higher, and the cost of carriage to the ground is less.

Crude night soil must be carefully and laboriously applied, and is for long not in a condition to benefit the land, which must meantime be kept out of cultivation, at any rate as regards most Indian crops; the effluent on the contrary is immediately available and is equably distributed by methods with which the cultivator is familiar.

It has to be noted first that we have to find water for the soil, and often at considerable expense of time, labour, and money; and that, secondly, there is always a certain amount of foul sullage water to be dealt with in every community even under the driest system, and the problem of the disposal of this is not touched on by Professor Ramsay's plan. The fact that the ordinary dilution of excreta in England ranges from 15 or 20 to 40 gallons per head does not imply that this quantity is required for the fermentation and partial resolution of the sewage under artificial biological conditions; successful results have been obtained in India with a dilution of five gallons, and even three gallons, per head. While manure must be accounted necessary for increasing the value of the crop, water is absolutely essential, and it resolves itself into the best time and method of its application, and there can be little doubt that it is best when containing in solution the readily assimilable manurial elements, and less valuable when poured over raw excreta under the influence of a burning sun. Agriculturists in this country are averse from using crude sewage, and demonstration of the value of *poudrette* has failed in most places to banish their prejudices, while the arrangements for the removal and application of excreta to the land are a constant source of danger and of economic loss owing to the ignorance and unreliability of the low-caste staff on which these essential operations depend. The cheapness of labour in this country is a consideration that is apt to carry too much weight; the number of "sweepers" is by no means equal to the demand in the larger centres, and they often control the situation in defiance of all disciplinary efforts, and they exhibit little sense of duty in their degrading task.

Finally, there are two considerations that have an important bearing on the question; in England the crux of the problem is to produce an effluent that can safely be diverted to a stream; there is always, under any process, an effluent to dispose of. In India, on the contrary, we need a manurial effluent that need not attain the arbitrary chemical standard of purity requisite in England as the land is its ultimate destination, where it disappears and is finally purified and disposed of to great advantage, the fluid being a cardinal necessity for cultivation; there is no ultimate effluent, for all is disposed of by crops or by the soil or by evaporation. And, secondly, the one conclusive fact which the

Indian experiments have demonstrated, is the extraordinary manurial value of a biological effluent as compared with crude night soil, while, moreover, its application can be adjusted to the actual needs of the land under treatment and so with a full economical realization of its value.

This is a matter of such importance that no attempt will be made in this place to present a detailed résumé of the evidence while the full and authenticated records are available in the "Notes on Sewage Disposal" * by Mr. James, M. Inst. C.E., and in the report by the Deputy Director of Agriculture, Bombay, on the cropping experiments at Manjri† in connexion with the Poona scheme. It may merely be stated that the actual income derived from the crops raised on about 3½ acres of land irrigated with effluent and attached to the Matunga Asylum, in the former case, has risen during the last two years to £278 and £380 respectively, giving a net profit on capital outlay (for construction of apparatus and preparation of land, but excluding cost of rent of land) of 21·9 and 26·07 per cent. respectively, results which have enabled the Asylum to increase its accommodation and to undertake the entire responsibility of maintaining fifty inmates without a call on the public revenues. At Manjri the financial results are equally remarkable, the profit on one crop, sugar-cane, raised on land irrigated by "biological" effluents, being authoritatively stated to be at the rate of from £44 to £53 per acre, while that from the same crop on land treated with farm-yard manure with castor cake and *poudrette* was only £20 and £32 per acre respectively. As compared with fresh "night-soil," it is said that the results were better from the use of the "biological" effluent.

It is obvious that the financial aspect of drainage and sewerage schemes assumes an altogether different complexion under these circumstances, and the fact has to be noted that in any case there is always the very serious problem of the adequate removal and disposal of enormous quantities of the foulest sullage water, which under present arrangements, for the most part, finds its way into house basements and into the soil on which they are built. This is indeed a problem that claims the urgent attention of all sanitary authorities and is scarcely secondary to that of the adequate removal of excreta.

In this connexion a new departure having very important sanitary and economic significance is to be found in the utilisation of ordinary town drainage (house-sullage) for the irrigation and manuring of land for cultivation which has been carried out at Meerut on the Demonstration Farm at that place. This sullage was simply diverted from the outfall drains outside the town, on to land under ordinary crops, and the cultivators were quick to realize its manifest advantages. The cultivators pay a small fee for the "lifts" which have been set up to raise the effluent to the level of the land for irrigation. The fee was at first 2*s.* 8*d.* for each lift, of which there are 45 in work, and the sum accruing to the Municipality amounts to £180 per annum, the whole of which is clear profit. It has recently been found possible to raise the fee to 8*s.* and 16*s.* per lift without restricting the application of the drainage. Three crops are derived annually from the land, viz., maize, potatoes, and tobacco in rotation, without any other dressing than that afforded by the sullage; this is a most exhausting series, and yet the manurial constituents of this sullage enable it to be maintained. The gross value of all three crops is reported by an agricultural authority to amount to "not less than £27 and probably more than £34 per acre." This land formerly received heavy dressings of *poudrette*, but the sullage is far more economical, and the rents have risen all round, in some cases to double their former assessments, and they now range from about £3 15*s.* to £7 10*s.* per acre.

It only remains to report that the sewage, including the excreta, of certain wards in some of the large towns in Bengal is already being satisfactorily dealt with on the so-called "biological system"; the matter has also advanced beyond the experimental stage in certain institutions, notably in the Matunga Asylum, Bombay, and in the Presidency Jail, Calcutta, reports on which have been published, while some of the results of the Poona experiments have been referred to. Beyond this, experimental installations are under trial in several cantonments, where the scope for their greatest utility is perhaps most undeniable, and in several municipal towns. We have now arrived at a stage when a careful critical and scientific examination of the results attained is necessary, for the conditions met with in this country will doubtless enable us to throw light on many of the problems that still confront the chemist and the bacteriologist in Europe, and it is from all points of view very desirable that Government should now institute an expert enquiry into the Indian results, and their possibilities of application in practice.

* "Times of India" Press, 1901

† Bombay Government Central Press, 1901

The Pasteur Institute of India.—As noted in last year's Report, this institution was opened for the active discharge of its responsibilities on August 9th, 1900, and the Committee have recently presented their first annual report. During the twelve months the total number of patients treated was 321, of which 146 were Europeans and 175 were natives of India, and it may be said that the benefits of the treatment have appealed with remarkable results to all classes of the population. There were 96 patients from the European army, 25 from the Native army, 50 from among European civilians and 150 from natives in civil life. As to the results, not a single death has occurred among the 146 European patients and there were only three fatalities among the natives, particulars of which are given in an appendix to the report.

Beyond the special anti-rabic inoculations, the Institute staff performed a considerable amount of bacteriological work, largely in connexion with the clinical diagnosis of enteric, malta, cerebro-spinal and malarial fevers, cholera and tubercle ; and beyond this, a considerable amount of pathological research and of ordinary chemical analysis. A large number of officers received instruction in the essentials of bacteriological work. One other important side of its enterprise that is likely to develop largely in the future is the production of protective sera ; as a commencement, one thousand doses of anti-typhoid vaccine were prepared and issued.

Altogether Major D. Semple, R.A.M.C., the able and enthusiastic Director, is to be congratulated on the very successful first year's work which on many sides holds out prospects of great development ; and that the benefits of this institution should be extended is the desire of the Government of India, who have recently placed an officer at the disposal of the Committee to act as Assistant to the Director.

The Prospects of Bacteriological Research.—The policy of Government in consolidating and extending the work of bacteriological research is also elsewhere developing practical results. The Central Research Laboratory has now been sanctioned, and work will, for the present, be commenced at Bombay under the direction of M. Haffkine, C.I.E., who has hitherto conducted the work of the Bombay Plague Research Laboratory. M. Haffkine will be assisted by a staff of officers selected for their approved knowledge of, and achievements in, bacteriological and chemical research, and it is under consideration to transfer the laboratory to some suitable hill site in order to obviate the exhausting conditions of work in the climate of the plains. The work already accomplished in the Bombay Laboratory has not been, by any means, confined to the manufacture of the plague prophylactic, and a note of some of the more important subjects to which research has been devoted during the past year is given in a subsequent paragraph.

It remains to be said that the proposals of the Government of India contemplate the establishment of a laboratory on similar, but somewhat less elaborate, lines in some central station of each Province, which will work to some extent in touch with the central institution, but be specially devoted to the elucidation of the problems of preventive medicine which press for solution within its own immediate environment. There is already an institution in Bombay in the present Plague Research Laboratory ; the North-West Provinces has a small laboratory in Agra under the control of Mr. Hankin, which only needs development and affiliation with the local school of medicine ; the Pasteur Institute is situated at Kasauli in the Punjab, and this will doubtless be supplemented, when circumstances permit, by a bacteriological department in association with the Medical College at Lahore, the capital ; the Madras Government has recently submitted proposals for the establishment of a Bacteriological Institute, to be combined with a central vaccine depôt, in association with the chair of Hygiene at the Medical College. The Bengal Government has still to move in this matter, the present urgent needs of that large province being served by the small laboratory which is under the control of the Sanitary Commissioner with the Government of India, and which is associated with the researches of Dr. Cunningham, F.R.S., I.M.S. (retired). Lastly, mention must be made of the laboratory at Muktesar, under the charge of Dr. Lingard, which is devoted to research in veterinary medicine. All these institutions, together with the newly established command laboratories specially provided for work in the army, are the growth of the last few years, and although they have already more than justified their existence, we can only be said to be now entering on the campaign with ordered and disciplined forces ; and herein lies the promise for the future of an even more remarkable advance in the control of preventible disease than it has been possible to record for the past in the opening sentences of this section. For it is hoped that we shall not only possess active centres of research, but that one of their chief functions will doubtless be the diffusion of a scientific knowledge of hygiene, in connexion, for instance, with the training of the executive

sanitary staff which must be largely extended in future ; and beyond this, each provincial institution should be the scientific laboratory of the sanitary and medical organizations within its sphere.

Records of Scientific Research.—The work of the Bacteriological Department will form the subject of a brief review in this Report, year by year, but in order to render all important advances immediately available to workers all over India (and to some extent in Europe) it has been decided to modify the issue of the "Scientific Memoirs by medical officers of the Army of India," which was originated in 1884 and of which twelve volumes have been published. The proposed issue will be made in a different *format*, each paper being published separately as soon as possible after the work to which it relates is concluded, so that the delay necessitated by a periodic issue will be obviated, and papers on the same or cognate subjects may be subsequently bound up together. It may be added that these "Memoirs" will not be confined to the record of the work done in the bacteriological laboratories, but will include reports of the more notable results of the labours of officers in all departments under the administrative control of the Director-General and Sanitary Commissioner.

The first issues include a paper by Captain Lamb, I.M.S., and Dr. Hanna on the "Standardization of Calmette's Antivenene"; one by Dr. Hanna on "Researches on Leprosy"; three by Captain Lamb, I.M.S., on the "Etiology and Pathology of Scurvy," on "The poison of Russell's viper," and on "The effects of Anti-cholera Inoculation"; and one by Captain Liston, I.M.S., on "The Structural Anatomy of Trypanosomum Evansi"; all the above are records of work carried out in the Plague Research Laboratory, Bombay. An early number will contain the Report by Captain James, I.M.S., on Investigations into the causation of malarial fevers, pursued in collaboration with the Royal Society's Commissioners, to which allusion has been made in the remarks on this subject.

Red Sea Pilgrim Traffic.—A very brief note will this year suffice to record the arrangements by which the pilgrim traffic between India and Mecca was conducted, for no material change has been made in them, and from the point of view of international public health, they were as usual attended by complete success.

Owing to the prevalence of plague, pious Musalmans were again warned to deter the sacred privilege to happier times, but for those who felt bound to go, all ports in India were closed to embarkation save only Chittagong, and this was only open after the intending pilgrims had been kept under observation by the Sanitary Authorities, and after disinfection of their effects. Three ships in all left this port carrying altogether 1,630 pilgrims for the Haj of 1900, and these were in the first place disembarked at the quarantine station in the island of Camaran, for detention and observation prior to their entry into Arabia and the holy places *viâ* the port of Jeddah. It is reported that about 200 more Indian pilgrims arrived at Jeddah by a roundabout route after proceeding to northern Red Sea ports and re-embarking thence, so that the total number of Hajjis credited to this country was 1,821, which is about equal to the number concerned in the pilgrimage of the previous year. Including these, there were altogether 11,155 pilgrims received at Camaran during the season extending from September, 1899, to March, 1900, a number which is about 3,000 less than that accounted for in the previous season. Only seven deaths occurred in the Lazaret, the principal causes of sickness being small-pox, rheumatism, chest diseases, and "ordinary fevers." Plague was reported at Jeddah, and cases occurred there between the 26th April and the 6th July, with a total of 82 fatalities, but it is said by the local authorities to have been introduced by coasting smugglers, or more probably overland from Assyr, where the disease is endemic ; it is certain that no Indian pilgrims were attacked by the disease during the sojourn in Arabia, but it is reported that one case of plague was landed at Aden from a pilgrim ship on the return voyage to India. No case of plague was reported from Mecca itself. There was a remarkable absence of cholera all along the route.

The Indian pilgrims returned at different dates from the end of April, 1900, to late in the year, as accommodation offered ; some 1,807 are thus accounted for, and they proceeded to Bombay, Calcutta, and Karachi, where they arrived without the occurrence of any notable sickness beyond the single case of plague which was landed at Aden, and of which particulars are wanting. The arrangements for the reception of the pilgrims in India were elaborate and carefully carried out ; in Bombay, the passengers from the ship on which the plague case occurred were kept under observation for 10 days, and the baggage and effects of all pilgrims were disinfected before they were allowed to proceed to

their destinations, those living up-country not being allowed to enter the city, but were sent from the ship to the railway and conveyed home at Government expense. At Calcutta, small-pox having broken out on the homeward voyage, the returned pilgrims were vaccinated, and after disinfection of their effects, were despatched by rail under escort to their destinations.

The above report was written, and refers to a period, prior to my assumption of the office of Sanitary Commissioner with the Government of India ; the proofs were passed by the late Surgeon-General Harvey..

ABSTRACT OF THE REPORT OF THE SANITARY COMMISSIONER FOR MADRAS FOR 1900.

(*Lieutenant-Colonel W. G. King, C.I.E., I.M.S.*)

General Population.

The population of the Presidency, according to the census of 1891, was 35,641,828, inclusive of Europeans and Eurasians. The estimated population is 38,805,409. During the year, 351,076 persons emigrated to places beyond this Presidency and 200,114 came into it, thus leaving the population of the Presidency at the end of the year poorer by 150,962 souls. The natural increase of the population for the year under report was 278,482.

It may be of interest to compare the population according to the census of 1901 (*a*) with that of 1891, (*b*) with the figures representing the estimated population, and (*c*) with its natural growth, as ascertained by adding to the census figure of 1891 the excess of births over deaths during the succeeding decade. The results obtained are contrasted in the subjoined table :—

Population as per census of 1891.	Population as per census of 1901.	Estimated population.	Natural growth of population.
35,641,828	38,219,807	38,805,409	38,109,559

As the Superintendent of Census Operations for 1901 remarks that the figures furnished to this office are "only provisional totals and not finally checked results," it is considered inexpedient to enter into further particulars.

Of the total census population stated above, vital statistics were furnished to this office for a population of only 33,045,683. Over 2·5 millions of persons are thus left out of account. These, as explained in last year's report, live chiefly in hill tracts or in zemindaries, places in which it is not possible to enforce any system of registration efficiently. Towards the close of the year under report, registration of vital statistics was made compulsory, under Act III of 1899, in about 400 villages. Beyond this, there has been no change in the system of registration pursued in the Presidency. The Revenue Department has done a good deal towards securing more correct registration in villages, being aided in its efforts in this direction by the District Sanitary Officers and by the Deputy Inspectors of Vaccination. This office has also rendered assistance by carefully scrutinizing the results obtained in each district and town, and drawing the attention of the officers concerned to instances in which there were reasons for regarding the work of registration as untrustworthy. In this connection and during the past year, these officers were addressed on 253 separate occasions.

Births in Districts.—The birth-rate for the year was 31·8, or 0·5 per 1,000 above that of 1899. This is the highest rate on record, as will be seen from the following statement.

Years.	Birth-rate on the census population.*	Birth-rate on the estimated population.*	Years.	Birth-rate on the census population.*	Birth-rate on the estimated population.*
1892	25·1	24·4	1897	25·3	23·0†
1893	26·9	25·9	1898	24·6	22·0†
1894	27·7	26·2	1899	31·3	27·4
1895	28·9	27·1	1900	31·8	27·1
1896	29·1	26·8			

* Inclusive of Europeans and Eurasians both in the births and population.
† Famine influence.

Considered individually, Madras, with a recorded birth-rate of 46·1 per 1,000, takes the lead among the districts and is followed by Chingleput with 40·2. The results obtained in thirteen other districts were also good, the rate registered in them having exceeded 30 per 1,000. In the remaining seven districts, the rate was above 25 per 1,000. This branch of district administration appears to have received more attention than in previous years, as evidenced by the good results achieved. Compared with 1899, it is observed that, with the exception of Anantapur, Bellary, Cuddapah Ganjám, Gódávari, Kistna, Tanjore, and Vizagapatam, all the districts show an improvement. The fall in the birth-rates in Anantapur, Bellary, Cuddapah, and Kistna must be ascribed chiefly to the prevalence of famine in those districts during the year. In the remaining districts it is probably due to a similar cause, viz., the high prices, bordering on famine rates, that were prevalent during the major portion of the year.

Considered with reference to sex, the proportion of male to female births was 104·6 to 100.

Classified according to races, the birth-rates were as follows :—Native Christians 30·7, Muhammadans 32·1, and Hindus 31·8 per 1,000 of their respective populations.

Deaths in Districts.—The deaths recorded during the year under report aggregated 770,859, or 23·4 per 1,000 of the population, as compared with 675,094, or 20·1 per 1,000 in 1899, the increase occurring in all the districts but four, viz., Bellary, Salem, South Canara, and Trichinopoly, and appearing mainly under cholera and fevers.

The following statement compares the death causation in the Presidency for a series of years :—

Years.	Birth-rate per 1,000 of population.	Percentage of deaths from						Death-rate per 1,000 of population.
		Cholera.	Small-pox.	Fevers.	Dysentery and Diarrhœa.	Injuries.	All other causes.	
1892	25·1	10·5	5·8	37·4	4·3	1·5	40·5	22·3
1893	27·0	5·0	4·2	39·9	3·6	1·6	45·7	19·3
1894	27·7	6·3	1·7	40·2	3·7	1·7	46·4	20·0
1895	29·1	3·2	0·8	42·1	3·6	1·6	48·7	19·6
1896	29·9	7·1	1·4	38·6	3·7	1·6	47·6	20·6
1897	28·7	17·3	2·6	35·3	4·7	1·4	38·7	25·4
1898	27·4	9·4	2·9	35·6	4·2	1·6	46·3	21·0
1899	31·3	4·3	2·5	36·4	4·6	2·0	50·2	20·1
1900	31·8	7·8	3·9	39·3	4·1	1·8	43·1	23·4

Excluding Madras, the highest death-rate in the Presidency was returned by the Nilgiris (34·4), followed by Tanjore (30·1). In the former case it appears to have been mainly due to the prevalence of fevers, while in the latter it was owing to the large

mortality registered both under cholera and fevers. As in the previous year, Ganjám returned the lowest death-rate at 16·4 per 1,000.

There was an improvement in 14 and a retrogression in 18 towns. The results prove that registration in these latter is defective and unreliable. From reports received from the collectors it is observed that in 23 out of the 33 towns, with a population of over 10,000, the provisions of Act III of 1899 have since been brought into operation. Better results may therefore be expected in future. Inasmuch as such a measure is calculated to bring about much-needed improvement, I see no reason why the Act should not be extended to the remaining towns.

The increased infantile mortality from 159·0 to 164·9 during the year under review must be set down as mainly due to the high prices of food that ruled during the greater part of the year.

Births in Municipalities.—The birth-rate for the municipal towns in the Presidency averaged 38·5 per 1,000 against 37·0 in 1899. Of the 61 municipal towns, two, viz., Tinnevelly and Vániyambádi, yielded annual birth-rates of 55·5 and 53·7 per 1,000 respectively. In 18 towns the rates obtained ranged between 40 and 50 per 1,000, while in 37 others the rates varied from 30 to 40 per 1,000. There thus remained four towns in which the rates recorded were less than 30 per 1,000. Comparing the year's results with those of 1899, it is observed that there was a decrease in the birth-rate in 25 towns and an increase in 33 towns. The decrease was very marked in Tirupattúr (18·6 per 1,000), Anakápalle (8·4), Adoni (7·4) and Chidambaram (6·8). In the case of the first-mentioned town it was brought about by the outbreak of plague, which scared away a considerable proportion of the population from the town, besides interfering with the work of registration in consequence of the attendant confusion. A reaction appears to have set in in the case of Berhampur, Chicacole, Parlákimedi and Cocanada, which showed signs of improvement last year. The cause of the decline is not apparent, and must be set down to laxity in the performance of the work of registration. It is satisfactory to note the increase in the birth-rate in Karúr, Bezwada, Kurnool, Ootacamund, Tiruvannámalai, Tinnevelly and Trichinopoly. Cuddapah also showed an increase over the previous year, but there is still much room for improvement.

Deaths in Municipalities.—The average municipal death-rate for the Presidency was 34·4 as against 30·7 in 1899, the increase being due, mainly, as in the case of rural areas, to the prevalence of cholera and fevers. As compared with the quinquennial average, there was an increase in the death-rate in 38 municipal towns and a decrease in 20 others. Compared, however, with the results of 1899 there was an increase in 43 towns and a decrease in 17. The increase was largest in Bezwada, Guntúr, Nandyal, Palni, Periyakulam, Palghat, Tinnevelly and Tuticorin, being largely contributed by cholera. In 26 towns there was an increase both under births and deaths which may be regarded as the result of careful supervision. The increased mortality in Madras appears mainly, as is to be expected, under fevers.

The average infantile death-rate for the municipalities was 223·3 for the year under report as against 223·9 in 1899. The falling off, small as it is, is noted with satisfaction, inasmuch as it has occurred in a year when the food-grains were selling very dearly, a circumstance which is inimical to infant life. There was an increase in the infantile death-rate in 31 cases, in 12 of which the increase was over 30 per 1,000.

Chief Diseases.

Cholera.—The total mortality from cholera amounted to 60,662, or 1·8 per 1,000 of the population, as against 29,082, or 0·9 per 1,000 in 1899. An increase is observable in almost all the districts. The number of affected villages was 6,051 as against 3,794 in the previous year. Madura, Tanjore, Tinnevelly and Gódávari suffered most, the death-rates in these districts having ranged between 4·7 and 3·0 per 1,000. As has been pointed out in previous reports, the incidence of mortality from this cause was heaviest in the districts affected by the south-west monsoon in July, August and September, and in those affected by the north-east monsoon in October, November and December.

From 49 out of 61 municipal towns, 5,789 (=2·7 per 1,000 of the total urban population) were reported from cholera, Periyakulam taking the lead with a death-rate of 20 per 1,000, followed by Tinnevelly (13·8) and Palni (12·4) per 1,000. The mortality was also heavy in 14 other towns, in which the rate varied from 10·1 in Tuticorin to 4·2 in Máyavaram. In Madras cholera broke out in an epidemic form about the middle of

last year, and continued till its close. In all, 606 persons died from this cause. In September, 1900, deaths from cholera were reported from certain villages lying in close proximity to the Red Hills tank. Effective measures were promptly adopted to combat the epidemic and thus protect the Madras water-supply from contamination.

Permanganate of potash, as a means of purifying contaminated sources of water-supply, continues to be favourably reported on by medical officers.

Small-pox.—Small-pox accounted for 27,692 deaths, as against 16,991 in 1899. They were reported from 5,891 villages in the Presidency as against 4,177 in 1899. The largest number of deaths occurred in Gódávari (7,298, or 3·5 per 1,000, Tanjore (3,853, or 1·7), South Arcot (2,585, or 1·2), and Madura (1,966, or 1·2). Of the 27,692 deaths reported, 8,249 were under one year and 7,269 under ten years of age, the proportion borne by these figures to the total mortality under this head being 29·6 and 26·0 per cent. respectively. As remarked in previous reports, infantile mortality from this cause cannot be minimized without having recourse to legislation. Until vaccination is made compulsory in rural areas, more satisfactory results cannot be hoped for. Although vaccination is appreciated by the bulk of the population, mothers are still reluctant to submit their children to the operation, being swayed by such considerations as tenderness of age, physical inability to bear the effects of vaccination, &c. During times of small-pox prevalence it is customary for local bodies to detail special vaccinators for work in the affected parts, with the object of reducing the number of the unprotected, but their best efforts are often thwarted by the unwillingness evinced by the people to undergo the operation while the disease is present. The total number of deaths from this cause, reported from the municipal towns in the Presidency was 683, or 0·3 per 1,000, as against 471, or 0·2 per 1,000, in 1899. The death-rate was large in Nandyal (4·2), Rajahmundry (2·3), Coimbatore (1·4), Dindigul (1·2), and Ellore and Vellore (1·1 each). The largest number of deaths reported from any town from this cause was 64. This number was registered in Coimbatore and Rajahmundry. Eighteen towns enjoyed complete immunity from this malady. The rate of mortality from this cause among the rural population was 0·9 per 1,000 against 0·3 in the case of the urban. The contrast afforded by these figures lends support to the demand for making vaccination compulsory throughout the Presidency.

Fevers.—Fevers contributed 288,521 deaths, as against 254,549 in 1899, the increase occurring in almost all the districts. Out of 39,922 villages in the rural areas, 24,367 villages returned deaths from fevers against 21,975 villages in 1899. The death-rate was largest in the Nilgiris (25·2), Vizagapatam (17·6), Cuddapah (15·3), Kurnool (14·7), Kistna (14·4), and Madras (13·3). Compared with the average rate for the five previous years, there was an increase in the death-rate in thirteen districts and a decrease in eight. The deaths were larger in the latter half of the year than in the former half and the greatest number was recorded in the month of December.

From municipal towns, 15,726 deaths were reported from this cause, as against 12,512 in 1899, the increase occurring in thirty-six towns, excluding Madras. The death-rate was largest in Nandyal (16·7), Kurnool (13·4) and Kodaikánal (13·2), and lowest in Vániyambádi (0·3), and Tirupattúr (1·5). These low rates are probably due to a large proportion of the deaths from fevers in these plague-infected localities having been registered under "other causes," to avoid the enquiry as to the cause of death, consequent on a report of "fever."

Dysentery and Diarrhœa.—Dysentery and diarrhœa caused 38,858 deaths, or 1·2 per 1,000, in 7,286 villages against 31,307, or 0·9 per 1,000, in 6,693 villages in 1899. The largest death-rate was recorded in Madras (7·7) and Chingleput (3·3). Compared with 1899, Malabar shows an increase of 1·1 per 1,000, Tinnevelly 0·8 and Ganjám, Madura, Nilgiris and South Canara 0·5 each per 1,000. When compared with the five-year average, it is observed that sixteen districts exhibit an increase. July and August were the months in which the greatest mortality from these diseases occurred. The municipal towns returned a total of 10,364 deaths, or 4·3 per 1,000 from these causes, as against 9,182, or 4·3 per 1,000, in 1899. Compared with the rural death-rate (1·2), the urban (municipal) shows a large increase (4·8). Setting aside the question of insanitary surroundings as determining the rate of mortality from this cause, this variation may be due to the greater accuracy in terminology secured in municipalities, where the agency employed for the registration of vital statistics is better educated and supervised than in rural areas. The death-rate was large in Tuticorin (10·7), Palamcottah (10·2), Chingleput (9·5), Gudiyáttam (9·4), Guntúr (9·4), Vizianagram (8·1), Bezwada (8·1), Palghat (7·9), Madras (7·7), Periyakulam (7·2), Coonoor (7·0), Vizagapatam (6·9), Ongôle (6·6) and

Parlákimedi, (6·0). As already explained in the report for 1899, the large mortality in these towns must be due either to defective conservancy or a contaminated water-supply, or to both.

Injuries.—The deaths registered in 1900 as brought about by injuries aggregated 13,677, or 266 more than in 1899. The death-rate was 0·4 per 1,000 of the population. The largest number of deaths by suicide (1,553) was returned by Gódávari (166), Malabar (135) and Tinnevelly (111). As usual, suicide among females was more frequent than among males. Compared with 1899, there was an increase in the number of deaths from wounds and accidents (from 9,441 to 9,707) and from snake-bites (from 2,036 to 2,217), and a decrease in the killed by wild beasts (from 236 to 200).

All Other Causes.—The deaths registered as due to unspecified causes ("other causes") amounted to 341,449 against 338,754 in 1899, giving a death-rate of 10·4 per 1,000 as against 10·1 in the preceding year. The increase in the death-rate is probably due to the indifference of the village officers in registering death causation, as explained in the report for last year.

Sanitary Works.

Municipalities.—The major works undertaken by the civic corporations, such as water-supply and drainage schemes, are dealt with in the Sanitary Engineer's report, forming Part II of the Sanitary Board's report. The minor works undertaken for execution fell under one or other of the following heads :—

(1) Construction and repair of wells and tanks.

(2) Construction and repair of drains, public latrines, cinerators, dust-bins, markets, slaughter-houses, &c.

(3) Improvement of village-sites, &c.

As has been pointed out in previous reports, the drinking-water supplies and drainage of the majority of the towns are defective to a degree, and until the defects have been remedied for some considerable time, it is useless to hope for evidence of any marked and lasting improvement in the public health.

The total estimated receipts for 1900–1901 amounted to £191,537. About 60·6 per cent. of this income was allotted for expenditure on sanitation. The actual expenditure during the first nine months of the year was 67·6 per cent. of the assignment. In no less than forty-five towns the proportion of the sanitary grant utilized in the period referred to fell below 75 per cent.

The annexed statement shows in detail the expenditure for the year 1899–1900 and for the first nine months in 1900–1901, under each item of sanitation :—

	1899–1900.			1900–1901.		
	Amount sanctioned.	Amount expended.	Rate per cent. of expenditure to total allotment.	Amount sanctioned.	Amount expended during the nine months ending December, 1900.	Rate per cent. of expenditure to total allotment.
	£	£		£	£	
For conservancy	57,595	42,333	73·5	49,689	34,987	70·4
For improvement of village or town sites.	15,751	15,006	95·3	18,401	12,815	69·6
For improvement of water-supply, cleansing, repairing, and construction of tanks and wells.	56,209	22,440	39·9	40,255	27,064	67·7
For sanitary arrangements during fairs and festivals.	2,104	705	33·5	816	455	55·7
For construction and repair of markets and slaughter-houses.	1,233	1,214	98·5	1,680	792	47·1
For other sanitary outlay ...	3,094	2,743	88·6	5,213	2,379	45·6
Total	135,986	84,441	62·1	116,054	78,492	67·6

District Boards.—The long-looked-for Amendment of the District Boards Act has at last been effected and the Act thus revised has come into operation since the 1st of April last (1901).

The sanitary works undertaken and carried out by local boards during the year consisted in the sinking and repairing of wells, construction and repair of tanks, latrines, drains, dust-bins, markets, slaughter-houses, etc., and the improvement of village sites and water-supply generally.

Tanks, wells, ponds, rivers, springs or canals were the sources from whence people obtained their supply of drinking-water. In the majority of cases watchmen were employed to prevent the water from contamination. Side cuttings, chiefly intended to carry off storm water, were the only means whereby the majority of the villages were drained. Out of a total of 39,921 villages, 583 were conserved, as against 640 in 1899. Of these, 380 were union and 203 non-union villages, the corresponding figures for the previous year being 384 and 256. The number of villages conserved was largest in Gódávari and smallest in the Nilgiris and Malabar.

The estimated receipts of the year (1900–1901) amounted to £801,338 against £574,323 in the previous year. Of this sum, £42,424, or 5·3 per cent., was set apart for sanitation. The expenditure during the first nine months of the year was only 57·6 per cent. of the allotment. With the exception of the districts of Ganjám, Gódávari, North Arcot and South Canara, the allotment was not fairly worked up to.

The following statement exhibits the expenditure on sanitation during the year :—

	1899–1900.			1900–1901.		
	Amount sanctioned	Amount expended.	Rate per cent. of expenditure to total allotment.	Amount sanctioned.	Amount expended during the nine months ending December, 1900.	Rate per cent. of expenditure to total allotment.
	£	£		£	£	
For conservancy	22,605	19,874	87·9	21,891	16,681	76·2
For improvement of village or town sites.	4,319	3,482	80·6	4,372	1,386	31·7
For improvement of water-supply, including cleansing, repairing, and construction of tanks and wells.	7,342	5,434	74·0	8,179	3,207	39·2
For sanitary arrangements during fairs and festivals.	1,266	878	69·3	1,224	582	47·5
For construction and repair of markets and slaughter-houses.	3,940	2,820	71·6	4,760	1,973	41·4
For other sanitary outlay	2,004	835	41·7	1,998	617	30·9
Total	41,476	33,323	80·3	42,424	24,446	57·6

Personal Proceedings and General Remarks.

Efforts were continued during the year to increase the efficiency of the registration of births and deaths. Reports of inspection of registers by District Medical and Sanitary officers, when disclosing want of care by the subordinates concerned, were transferred by me, with remarks, to Collectors of districts. Collectors were invited to forward statistics of villages, under the Compulsory Registration Act (Madras Act No. III of 1899), with the object of ascertaining how far this Act met the difficulty, referred to in my preceding reports, of the revenue headmen of villages being saddled with the duty of registration when the population assumes unmanageable dimensions. Municipalities were again addressed as to the necessity for following up failure to register by prosecution. In connection with a reference on the subject of existing arrangements for registration in the City of Madras, my recommendation of 1891 as to the advisability of having a double set of registers in large towns where qualified practitioners exist, so as to secure correct nomenclature in at least a certain percentage of cases, was again submitted to Government. Proposals having for their object the limiting of the influence of the existing form as used in rural areas for registration, in bringing about stereotyped returns of deaths under "all

other causes," have lately been placed before Government. As soon as it was possible, month by month, to collect and review the statistics received from all parts of the Presidency, the attention of each of the authorities concerned was invited to defects discovered in registration. Irrespective of such efforts on the part of this office, reports received from various districts show that increased attention has been bestowed on the subject by District officers.

Allusion has already been made to financial difficulties causing hesitation on the part of municipalities to undertake new sanitary works. Whilst, in the case of these towns, there is some excuse for this state of affairs, the tendency on the part of certain of the Local Fund Bodies to omit to make provision in their budgets for permanent sanitary improvements, under Grant I. cannot be so regarded. I consider it essential that each Local Fund Board be required to show, year by year, that it has carried out some permanently useful sanitary work Nevertheless, 117 separate references for opinions as to plans and estimates for sanitary works have been dealt with from a sanitary point of view by me, on behalf of the Sanitary Board during the year.

The revised District Boards Act, to which I have long looked forward, in the hope that it would secure certain, hitherto impossible, elementary reforms in rural areas, was published during the year and will come into force in April, 1901. It contains several advantageous sanitary rulings that cannot fail to be of utility in such primary matters as protection of water-supply, conservancy, and the combating of infectious diseases. Without, however, the executive machinery for using the legal powers thus gained, no advance can be expected ; yet, although the subject has frequently been pressed upon their notice, Local Boards possess but few Certificated Sanitary Inspectors. Frequent refusals to entertain even the class of men now available as Certificated Sanitary Inspectors, on the ground of "want of funds," has proved to me that it would be hopeless to persuade these Bodies, for the next few years, to entertain the scheme I had advanced in 1899, for the entertainment of the numerous unemployed graduates in Arts of the Madras University who, though laymen, would, subsequent upon special education, form good substitutes, in most respects, for Medical Officers of Health, who apparently cannot be afforded.

Having abandoned the scheme for Chief Certificated Sanitary Inspectors, I laid before Government proposals for ensuring tenure of appointments and for improving the pay, status, and education of existing Certificated Sanitary Inspectors. The matter is under its consideration. Of this class of men 16 are now employed by District Boards, and 108 by Municipalities. They have also been more freely employed than formerly in temporary capacities for cholera duty, by the more enlightened of the Local Bodies. By order of Government, none but such specially trained men are now employed on plague duty. During the year, 51 men passed the practical and theoretical examination, after training in the Medical College ; so that there is now available a total of 322 men holding certificates.

The advantage of training Sanitary Inspectors is likely to be no longer confined to the Civil Department, as the Lieutenant-General, Madras Command, has adopted my recommendation to send selected British soldiers to Madras, for training at the Medical College, with a view to future service in cantonments, and Government has agreed to this being given free of cost. If sufficient inducement were offered in the way of pay, it is possible that British soldiers educated at Madras could be made available for service in cantonments and barracks in other parts of India. The men sent for training must, however, be selected with care, as the standard of general education assumed for Certificated Sanitary Inspectors is the Matriculation examination of the Madras University. It is probable that even this standard will be raised, so that only those who have passed in the "first class" will be accepted.

I have for many years made enquiries as to the existence of tuberculosis amongst cattle in this Presidency. I have not been in a position to inspect many carcasses myself, whilst the scanty information received from other officers has constantly been of a meagre nature. Nevertheless, I think it very unlikely that tuberculosis does not exist amongst cattle, as the affection is common enough amongst the poor—more especially in the large city of Madras. With the hope, therefore, of gaining evidence from the living animal, I imported tuberculin for distribution to selected officers ; but, so far, no reports of positive results have reached me.

Captain Giffard, I.M.S., supplied this office with an excellect abstract of marked nerve symptoms found by him in the severe beri-beri epidemic amongst sepoys in the Northern Circars—an outbreak alluded to in my previous report. The report is of interest, in view of the scepticism of certain authorities as to the existence of the disease in this area.

In connection with malaria, special descriptive circulars were issued to all local bodies and certificated sanitary inspectors inviting them to do their best to exterminate the anopheles, and to limit infection by the use of quinine. At the same time, I pointed to the fact that former theories in regard to the influence of surface and sub-soil drainage had gained—not decreased—in value by the new theory, whilst in the light of Manson's hypothesis as to the possibility of the existence of a second extra-corporeal form of the *plasmodium malariæ*, I included a warning against the premature abandonment of the additional theory of water infection. To several local bodies and certificated sanitary inspectors specimens of the anopheles were forwarded, to aid their recognition. These were procured for me by Mr. Nagaraj, B.A., a resident of Madras, taking an interest in entomology. He has been able to find three species of culex in Madras city that possess spotted wings, so that, without care as to other characteristics, the anopheles are not so easily identified as at first hoped. Communication by him of the fact to Major Giles showed that that authority has also found specimens in the North of India. Such specimens of culex, with one exception, as had been previously identified with spotted wings, were not of Indian origin.

The action of municipalities under G.O., No. 1536-M., dated 9th September, 1896, referring to precautionary measures against cholera, was carefully watched. There was a constant tendency to employ small and inefficient staffs—a practice, which, in view of the existence of rules duly approved by Government, gave rise to much unnecessary reference. Action under this head was considerably hampered, for the best part of the year, by disturbance of the methods of reporting to this office by local bodies, due to a ruling by the Board of Revenue. Under Government Orders, this matter has now been satisfactorily rectified.

No change in policy as to plague measures was made by Government. The "passport system" formed an important item in methods adopted and was a means of securing the detection of first imported cases in a large number of instances. The whole of the Plague Regulations were revised by Government, and were reduced to a more convenient form for reference. In doing so, the recommendations of the Plague Commission were held in mind. A pamphlet published by me privately for guidance of Plague Inspectors was accepted by Government as an official manual and was revised by me for the purpose. The Surgeon-General and the Sanitary Commissioner were directed, in consultation, to supplement Government rulings by executive directions in their respective branches. These have been completed. As a special report will be written by my successor on plague measures adopted, it is unnecessary to further enter into the subject.

The Vaccine Institute for this Presidency referred to in my last report has now been definitely sanctioned, and suggestions for plans have been handed to the Sanitary Engineer and the Consulting Architect. The question of combining this with a bacteriological laboratory remains under consideration.

Dr. Srinivasa Rao, Bacteriologist to the Mysore Government, communicated to this office the results of an important series of experiments on the comparative values of lanoline, glycerine, and vaseline as preservatives of animal vaccine, which shows my contention that lanoline is, in a tropical climate, and under ordinary conditions of storage (without ice) and of transport, the best available preservative, to be correct, and, further, that in respect to "extraneous organisms"—concerning the advantage of getting rid of which I think there exists some exaggeration of facts—their gradual extinction proceeds not only with glycerine but also with lanoline. This power was at first publicly admitted by Dr. Copeman as to lanoline, as a result of his own experiments, and then denied—apparently on the strength of Dr. Bloxall's experiments. The point of Dr. Srinivasa Rao's experiments, however, lies in the fact that he finds really sterile specimens of glycerinized vaccine are not produced by the process adopted by the Local Goverment Board as a result of Drs. Bloxall and Copeman's experiments either at the Jenner Institute or by private firms in England. He further verified Gottstein's dictum as to the impenetrability of lanoline by microbes introduced on the surface: a quality which first made me think of its suitability for vaccine preservation. Dr. Copeman quotes the growth of fungi as an objection, but, obviously, such results occur only in specimens that have been carelessly exposed. In the new Vaccine Institute difference of opinion on such points will be ignored, and both glycerinized and lanolized vaccine will be issued to District Boards, according as local medical officers may elect. Practical experience will ultimately decide between halting opinions.

The question of conservancy of towns is steadily receiving more attention from local bodies, whilst the various methods of biological purification of sewage are likely to

become popular. The people especially realize the convenience of using household sewage filters. The Civil Surgeon, Guntúr, made experiments with the dhobi platforms arranged as biological filters, which I had advised, with satisfactory, though limited, results. Certain municipalities have been asked to make experiments as to the nutrient power for crops of filter effluent and crude sewage respectively. In 1894 I advised the Municipality of Madras to filter such part of its sewage as could not be utilized on its farms, and thus prevent sewage being allowed to flow to undesirable outlets. In a communication to Government I invited its attention to this suggestion, and advised that if carried out fully it would get rid of the nuisance caused by the locally-notorious Cooum.

I sat upon a committee appointed to consider the question of sewerage of Fort St. George.

Two hundred and thirty-seven reports of sanitary inspection of towns and villages were received from District Medical and Sanitary Officers. Extracts dealing with important matters, with my remarks thereon when necessary, were forwarded to the local bodies concerned, and action by them was carefully traced.

NOTE ON PLAGUE BY THE ACTING SANITARY COMMISSIONER, MAJOR A. E. GRANT, I.M.S.

It is unnecessary, I consider, to go into details regarding the history of plague in this Presidency during the year, inasmuch as the whole matter is clearly recorded in the *Plague Returns and Narrative* submitted month by month to the Government of India by the Government of Madras. A few points, however, may be referred to in this report.

During 1900, plague followed a very similar course to that taken by it in the preceding year. The total number of attacks throughout the Presidency during the year was 895, of which 665 proved fatal. The severe outbreak in Tiruppattúr, alluded to in last year's report, was almost exactly duplicated in regard to point of time, insidious and unrecognized onset, gradual spread, &c., in the neighbouring town of Vániyambádi. These towns are also peculiar, so far as regards this Presidency, in containing a very large proportion of Muhamadan inhabitants. The majority of those in Vániyambádi are of the *Lubbai* class—the most ignorant and obstructive race, excepting, perhaps, the Moplas, in Southern India. Happily, the indigenous cases throughout the year have been confined to the Salem district.

The history of these outbreaks lends very strong support to the importance of continuing to employ preventive measures, in full, until at least one cold weather season has elapsed without the occurrence of any cases of plague. Or, to put it another way, they emphasize the necessity for undiminished vigilance, throughout the hot season, in an infected area and its neighbourhood, so that the disease may be attacked as it sinks to its minimum with a reasonable hope of success. The saving effected by reducing the plague establishment *pari passu* with the "hot weather" decline in the number of attacks, is apt to prove merely apparent and but false economy when it is found that by such procedure a way has been opened for the recrudescence of, or re-infection with, this disease, unrecognised till it has once more gained a firm foothold.

The relationship between plague and temperature has been as clearly marked as usual.

No fewer than 57 cases were imported to Bellary, Ganjám, Chingleput, North Arcot, Vizagapatam, Madras, South Canara, Nilgiris, Tinnevelly, Anantapur, Trichinopoly, and Malabar, but in none of these instances did the disease obtain a foothold.

The system of passports, observation, and railway inspection, in spite of irresponsible and superficial criticism to the contrary, worked extremely well on the whole. At Jalarpet no fewer than 114 cases were detected and detained. Nothing approaching perfection has been reached, but that a very effective check to the general spread of the disease has been afforded by means of observation and preventive circles, railway inspections and the passporting of travellers from infected areas, cannot be doubted.

It is a regrettable fact that personal observation and the privately expressed opinions of responsible plague officials go to show that it is by no means the ignorant and lower classes who alone oppose or seek to discredit the efforts of Government in these directions, and it is much to be desired that officials and other Europeans of good standing should refrain from expressing strongly-worded opinions on the "absolute uselessness" of such measures; and from exhibiting a petulance in responding to the demands of inspecting officers, which is alike undignified and uncalled for. The work of a Medical Officer at an inspecting station is far from congenial at the best; at the worst

it calls for a marvellous degree of quiet persistence coupled with tact and self-restraint. It is but reasonable, therefore, to expect that such work shall arouse not the hostility but the sympathy of those members of the educated public whose duties or pleasures entail much railway travelling.

During the year that excellent manual *The Plague Inspector* was carefully revised by its author, Lieutenant-Colonel King, C.I.E., and was constitued an official publication. Government has also sanctioned the issue of the clear and simple Sanitary Rules for Prevention of Plague in Municipalities, by the same authority, to all municipalities. In addition, the Regulations and Rules for Combating Plague have been revised and codified by Government and an explanatory appendix issued therewith. By means of these three carefully prepared publications, the whole matter has been very much simplified, and, so far as I am aware, they form by far the clearest expositions of plague regulations and procedure in India.

Sanitary Engineering.

The Acting Sanitary Engineer visited 23 towns, and the Assistant Sanitary Engineer eight towns during the year. In 1899 they visited 16 and 9 respectively. Surveys for water-supply were completed in three municipalities, and were in progress in three others. A drainage survey was completed in one municipality. Water-supply schemes for seven towns were prepared and submitted during the year. An estimate for a complete drainage scheme for Ootacamund was prepared and submitted. Improvements to the Trichinopoly water-supply were commenced and completed, and the Cuddapah waterworks were extended during the year. The scheme for the joint water-supply of Saidapet and the Mount Cantonment was still under consideration. Advice was given to the Sanitary Board in respect of 19 municipalities and 45 local fund schemes. Five type designs for various sanitary works were prepared and approved during the year. The Inspector of Steam Boilers and Prime-movers visited seven pumping stations, some of them two or more times, and made a complete examination of the machinery.

Sanitary Board.—The constitution of the Board remained unchanged. During the year the Board scrutinized the plans and estimates of 108 sanitary works. Of these, 20 were for Municipalities, 87 for Local Fund Boards, and one for the public Works Department. The total estimated value of the projects amounted to £20,230.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER FOR BOMBAY FOR 1900.

(*Lieutenant-Colonel J. W. Clarkson, I.M.S.*)

General Population and Vital Statistics.

The census was taken on the 1st March, 1901, and it will be of interest to compare the figures obtained with those made out by deducting the deaths from the births since 1891.

In the first five years of the decade, the registered births exceeded the deaths by 549,797, and the increase occurred in all districts except Bombay City, Broach, Kaira, and Ahmedabad, in which the deaths exceeded the births by 48,544, 1,651, 8,255, and 22,854, respectively. the years 1892, 1893, and 1894 being the years in which the high death-rate occurred.

In the last half of the decade, however, owing to the bad years of 1897, 1899, and 1900, the registered deaths exceeded the registered births in all the collectorates except Dháwár, Kánara, Shikárpur, and the Upper Sind Frontier, but on the whole ten years the total diminution of population is 241,547 and the decrease is shown in the City of Bombay, every Gujarát District, Násik and Thána in the Western Registration District, and Poona in the Central Registration District.

Comparing the figures thus obtained by registration with the census figures, very striking discrepancies are observed.

A table is attached showing this. The census figures for 1901 are those furnished by the Provincial Superintendent of Census Operations and include Europeans and Eurasians, and so for purposes of comparison census figures for 1891 of Europeans and Eurasians have been added to the native population as shown for 1891. It is stated that there is not likely to be much difference between the census figures of 1891 and 1901 as regards Europeans and Eurasians, but on this point I am doubtful and should think there had been a fairly substantial increase. If this is found to be the case the difference now shown between the census and registration figures as regards the native population will be much lessened. The census figures show an increase over the registration figures in the collectorates of Thána, Kolába, Dhárwár, Ahmedabad, all collectorates in Sind and in Bombay City. In the City of Bombay the registration, especially of births, is defective, and in Sind it is known that the registration of births, especially of female infants, is below what it should be. In Ahmedabad, Thána, and Dhárwár the increase may be accounted for by immigration. It is the decrease shown in the census figures over those shown by registration which is so difficult to account for, as in some cases the differences are so large. Accepting the census figures as correct, there are two causes which may partly account for the deficiency. One is that the emigration in search of work to foreign territory, such as is known to have taken place from Ahmednagar, Sholápur, and other places after the rains of 1900, has been much larger than was calculated, and the other is that all the deaths which took place have not been registered. The Deputy Sanitary Commissioner, Gujarát Registration District, considers that this has been the case in Gujarát, and it is possible in Khándesh also, but why the difference should be so great in places like Sátára, Belgaum, and Bijápur is difficult of explanation, except it is the continued effect of emigration and deficient registration, but on the whole the difference is

not so large, and considering the agency by which registration is carried out, it is satisfactory that the difference is not larger :—

Collectorate.	Census of 1891.	Increase for the years 1891–1900 of		Total according to Registration.	Census figures for 1901.	Difference between Census and Registration figures.	
		Births over Deaths.	Deaths over Births.			Increase.	Decrease.
Khándesh	1,460,851	32,007	—	1,492,858	1,442,018	—	50,840
Násik	843,582	—	4,164	839,418	819,575	—	19,843
Thána...	819,580	—	18,141	801,439	809,361	7,922	—
City of Bombay ...	821,764	—	257,504	564,260	770,843	206,583	—
Kolába	594,872	9,442	—	604,314	605,165	857	—
Ahmednagar... ...	888,755	34,507	—	923,262	837,774	—	85,488
Poona...	1,067,800	—	27,382	1,040,418	995,074	—	45,344
Sholápur	750,689	17,679	—	768,368	720,978	—	47,390
Sátára...	1,225,989	16,134	—	1,242,123	1,146,521	—	95,602
Ratnágiri	1,105,926	70,058	—	1,175,984	1,166,890	—	9,094
Belgaum	1,013,261	36,813	—	1,050,074	994,209	—	55,865
Dhárwár	1,051,314	50,399	—	1,101,713	1,113,426	11,713	—
Bijápur	796,339	64,774	—	861,113	735,041	—	126,072
Kánara	446,351	9,553	—	455,904	454,238	—	1,666
Surat	649,989	—	4,337	645,652	636,602	—	9,050
Broach	341,490	—	48,087	293,403	291,428	—	1,975
Kaira	871,589	—	105,500	766,089	715,725	—	50,364
Panch Mahás ...	313,417	—	45,869	267,548	261,870	—	5,678
Ahmedabad	921,712	—	154,483	767,229	795,094	27,865	—
Karáchi	564,880	7	—	564,887	607,439	42,552	—
Hyderabad	884,434	15,296	—	899,730	990,502	90,772	—
Thar and Párkar ...	332,415	1,778	—	334,193	364,168	29,975	—
Shikárpur	915,497	53,921	—	969,418	1,018,237	48,819	—
Upper Sind Frontier	174,548	11,552	—	186,100	232,462	46,362	—
Whole Presidency	18,857,044	—	241,547	18,615,497	18,524,640	—	90,857

European and Eurasian Vital Statistics.

The European civil census population of 1891 in the Bombay Presidency, exclusive of cantonments in quasi-foreign territory, is 18,486. During the year 1900, 260 births and 373 deaths were recorded against 221 and 231 in 1899—a birth-rate of 14·06 per 1,000 against 11·96 in 1899 and a death-rate of 20·17 against 12·52.

The Eurasian census population of 1891 is 8,519. During the year 1900 the births amounted to 149 against 166 in 1899 and the deaths to 247 against 185, the rates being 16·20 per 1,000 against 19·49 in 1899 and 29·0 against 21·72.

The causes from which deaths among Europeans and Eurasians were recorded are given in the following table :—

Causes of deaths.		Europeans.				Eurasians.			
		1900.		1899.		1900.		1899.	
		Number of deaths.	Ratio per 1,000 of population.	Number of deaths.	Ratio per 1,000 of population.	Number of deaths.	Ratio per 1,000 of population.	Number of deaths.	Ratio per 1,000 of population.
Bombay Presidency.	Cholera	31	1·68	2	·11	23	2·70	—	—
	Small-pox... ...	21	1·14	—	—	11	1·29	1	0·12
	Plague	11	·59	16	·87	12	1·41	32	3·76
	Fevers	35	1·89	27	1·46	19	2·23	16	1·88
	Dysentery and Diarrhœa.	59	3·19	26	1·41	44	5·16	21	2·46
	Injuries	10	·54	8	·43	4	·47	8	·94
	Other causes ...	206	11·14	152	8·24	134	15·73	107	12·56
	All Causes ...	373	20·17	231	12·52	247	28·99	185	21·72
Cantonments in quasi-foreign territory.	Cholera	1	*	—	—	—	*	—	—
	Small-pox ...	1	*	—	—	—	*	—	—
	Fevers	1	*	—	—	1	*	—	—
	Dysentery and Diarrhœa.	1	*	—	—	1	*	—	—
	Injuries	1	*	—	—	—	*	—	—
	Other Causes ...	3	*	3	*	—	*	—	—
	Total ...	8	*	3	*	2	*	—	—

* As the population for the cantonments in quasi-foreign territory is not obtainable, the ratio of deaths cannot be worked out.

Native Population— Vital Statistics.

Births.—In the Presidency of Bombay, including Sind, during the year 1900, there were 505,662 births registered against 685,348 in 1899. The recorded births for the year under report were less by 179,686 than the number registered in the previous year, and also less by 150,597 than the decennial mean ending 1899. By sexes there were 262,837 males and 242,825 females against 355,869 and 329,479 in 1899. In only four districts, Dhárwár, Kánara, Shikárpur and Upper Sind Frontier did the number of births exceed the deaths.

The recorded birth rate for the year was 26·87 per 1,000, the lowest for the past 10 years, against 36·42 in 1899, and a decennial mean of 35·32, a result due to the weakness induced by famine. For every 100 male births during the year there were 92·39 female births.

The number of births recorded during the year is less in every collectorate than in the previous year except in the City of Bombay and the Kánara district. It is most serious in the Gujarát districts, but all the famine-affected areas have suffered. The Deputy Sanitary Commissioner, Sind registration district, observes that : "The very low birth-rate recorded in Thar and Párkar district is probably due to the exodus caused by the scarcity which prevailed in the desert areas, and to the effects of the scarcity and to cholera."

The recorded birth-rates among the urban and rural populations of the Presidency were 23·72 and 27·30 against 26·48 and 37·80 in 1899. Except in the collectorates of Khándesh, Ratnágiri, Bijápur, Kánara, Broach, Kaira, Panch Maháls, Ahmedabad and throughout Sind, the birth-rates were higher among the rural than in the urban population. The urban rates were greatly affected by the famine and plague, but it is usual for healthy rural areas to have higher birth-rates than crowded towns.

Out of 56 towns in the Presidency, 10 had a birth-rate exceeding 40 per 1,000. Poona, Belgaum, Ahmednagar, Násik, Bombay, Thána and Karád have very low birth-rates.

Deaths.—Among the civil population in the rural, town, and cantonment circles in the Presidency, 1,318,783 deaths were registered during the year 1900. In 1899, 672,269 deaths, or 646,514 less than in 1900, were recorded. This result is chiefly due to famine.

The following statement shows the number of deaths recorded in each year since 1890 :—

1890	...	... 463,616	1894	...	... 607,179	1898	...	... 548,825
1891	...	... 513,132	1895	...	... 538,540	1899	...	... 672,269
1892	...	.. 611,742	1896	...	... 596,472	1900	...	... 1,318,783
1893	...	... 511,831	1897	...	... 749,916			

Of the total deaths registered, 706,275 occurred among males and 612,508 among females, against 355,241 and 317,019 respectively, in 1899. The death-rate per 1,000 in 1900 was 70·07 against 35·72 in 1899, and a decennial mean of 31·28. The millesimal rate of males dying to males living was 72·53, and of females dying to females living was 67·43. In 1899 these ratios were, respectively, 36·48 and 34·90. For every 100 females who died, 115·31 deaths among males were recorded, but these proportions vary considerably in the following collectorates and districts :—

In Násik	the ratio of male to female deaths was		116·79	per cent.
„	the City of Bombay	do.	133·69	„
„	Ahmednagar	do.	116·42	„
„	Sholápur	do.	117·11	„
„	Kaira	do.	124·02	„
„	Panch Maháls	do.	123·19	„
„	Karáchi	do.	127·88	„
„	Hyderabad	do.	124·46	„
„	Thar and Párkar	do.	134·89	„

The highest death-rate occurred in the Gujarát Registration District (156·47), which, with the Western and Central Districts, suffered severely from famine. The Southern and Sind Registration Districts were not nearly so severely affected by famine. The death-rates in 1900 were higher than the decennial mean in all the collectorates except Dhárwár and Kánara, and also higher than in the previous year in all the collectorates except the collectorates of Belgaum, Dhárwár and Kánara.

The Deputy Sanitary Commissioners, Western Registration District, Central Registration District and Gujarát Registration District, attribute the high mortality to famine. The Deputy Sanitary Commissioners, Western Registration District, and Gujarát Registration District are both of opinion that all the mortality has not been registered owing to defective registration and the confusion caused by the sudden and sweeping outbreaks of cholera, and the Deputy Sanitary Commissioner, Gujarát Registration District, is inclined to attribute one-third of the total deaths to immigrants. The Deputy Sanitary Commissioner, Southern Registration District, considers the chief causes of mortality to be plague in Belgaum and Dhárwár, and cholera in Belgaum, Dhárwár and Bijápur Districts. The Southern Registration District alone shows a lesser rate of mortality than in the previous year, though it is above the 10 years' mean.

The highest death-rates are shown by the collectorates of Panch Maháls (281·06), Ahmedabad (173·03), Broach (163·82), and Kaira (148·44), all in Gujarát, and the lowest is found in the Upper Sind Frontier.

In every collectorate the death-rates amongst males were in excess of those amongst females, except in the City of Bombay, Shikárpur and the Upper Sind Frontier. In 1899 the female death-rates exceeded those among males in the City of Bombay and the Upper Sind Frontier.

Comparing the birth and death-rate in each collectorate for 1900, the birth-rate was much below the registered death-rate in all the collectorates except Shikárpur and Upper Sind Frontier. In the collectorates of Shikárpur and Upper Sind Frontier the recorded birth-rates (29·54 and 28·86 per 1,000) were above the registered death-rates (25·99 and 25·42). In all other collectorates the recorded death-rates were higher than the registered birth-rates.

The Deputy Sanitary Commissioner, Western Registration District, remarks that "the outstanding features of the vital statistics of the Western Registration District for the year 1900 are the enormous increase in the registered mortality and the hardly less marked falling off in the number of births. Both are effects of the same cause, famine, which lowers the birth-rate by enfeebling the people and by breaking up families in the search for work, while in time of famine few marriages take place. The increased mortality has shown itself under every heading except plague, which is now gradually losing power in Western India. The greatest rise in mortality has occurred in Khándesh, which records a death-rate of 97·03 per 1,000 compared with 39·86 for the previous year. The death-rate, high as it is, falls far short of the actual fact, the defective registration of births and deaths in the hilly western and northern portions and the Bhil country generally making even an attempt at an estimation impossible."

The Deputy Sanitary Commissioner, Southern Registration District, remarks "the low birth-rate recorded in 1900 must be ascribed to famine and plague prevalence. The usual routine measures to obtain accurate registration were carried out. To obtain accurate data compulsory registration will eventually have to be enforced. Amongst the causes of death, plague was prominent in Belgaum and Dhárwár Districts, and cholera in Belgaum, Dhárwár, and Bijápur districts."

The Deputy Sanitary Commissioner, Gujarát Registration District, states that "the increase in the number of deaths is due directly or indirectly to famine; directly through deaths from starvation, and indirectly through the reduced condition of the people engendering a predisposition to disease."

Deaths by ages.—As regards deaths by ages, the figures show that by ratio per 1,000 of population the largest number of deaths took place in the period "under one year of age" and next in the age-period "60 years and upwards," the lowest ratio being in the period 15 and under 20 years of age relatively compared with the previous year, a by no means healthy year: the greatest increase in mortality is in the age-period 5 and under 10 years. Taking the percentage on total deaths, the age period "1 and under 5 years" gives the highest figures and then the period "60 years and upwards."

Deaths by causes.—The subjoined table shows the deaths in 1900 arranged according to the specified causes laid down by the Government of India and contrasted with the results for 1899 and with the decennial mean. The "causes of deaths" will be briefly noticed in the next section :—

Causes of deaths.	Mean for 10 years, 1890–1899.		1899.		1900.	
	Number.	Ratio per 1,000 of population.	Number.	Ratio per 1,000 of population.	Number.	Ratio per 1,000 of population.
Cholera	23,077	1·24	8,579	·46	163,889	8·71
Small-pox	3,024	·16	1,946	·10	9,885	·52
Plague	Not available.		96,596	5·13	33,196	1·76
Fevers	382,332	20·57	228,438	12·14	543,319	28·87
Dysentery and diarrhœa ...	46,568	2·51	74,736	3·97	218,243	11·59
Injuries	6,276	·34	7,102	·38	8,224	·44
Other causes	120,076	6·41	254,872	13·54	342,027	18·17
All causes	581,353	31·28	672,269	35·72	1,318,783	70·07

During 1900 the greatest number of deaths (162,555) took place in July and the least (66,250) in December. In 1899 the greatest and least numbers occurred in March (65,190) and June (42,282).

The heavy mortality, which is shown by an increase under every heading except plague, is due to famine.

The recorded death-rates among the urban and rural population of the Presidency were, respectively, 102·33 and 65·57 per 1,000 of population against 64·10 and 31·76 in 1899.

Chief Diseases

Cholera.—In the year 1900 there were 163,889 deaths recorded as due to cholera compared with 8,579 deaths from the same cause in 1899. Every district in the Presidency was affected, the collectorate of Kánara escaping lightly with only 82 deaths during the year. Khándesh, Thána, Sátára, and the Gujarát districts suffered severely, and it is doubtful if all the deaths under this heading in the Khándesh and Gujarát districts were entered, owing to the suddenness and virulence of the outbursts.

In December, 1899, cholera deaths were reported from the collectorates of Dhárwár and Bijápur and the City of Bombay. In January of the year under report, the disease continued in the same collectorates, Khándesh being affected in addition. There were 388 deaths reported, but out of these 352 were recorded in Khándesh alone. In the month of February the same districts, except Bijápur, returned deaths, Sholápur returning one death only in addition. In the month of March the same collectorates continued to be affected, but instead of Sholápur the collectorate of Násik began to return deaths. In April the mortality was especially heavy in the collectorates of Khándesh and Násik, 8,260 deaths and 2,908 being respectively reported. During the same month, in addition to the above, all the Gujarát districts and the districts of Thána, Ahmednagar, Poona, and Sátára were affected, and the districts of Sholápur and Bijápur, in which cholera had ceased, again reported deaths. In May all the districts returned deaths from cholera except Kánara, Karáchi, Hyderabad, Shikárpur and the Upper Sind Frontier. In June the collectorate of Hyderabad was affected in addition, and in July, in which the largest number of deaths for the year was returned, all collectorates, except the districts of Kànara and Upper Sind Frontier, were affected. From August, however, the mortality rapidly diminished month by month, but deaths were reported from Kánara in this month and from the Upper Sind Frontier in September. In December 488 deaths were reported from 9 Registration Circles—Bombay City (16), Poona (3), Ratnágiri (13), Belgaum (96), Dhárwár (171), Bijápur (44), Kánara (32), Karáchi (107), and Hyderabad (6).

By seasons 106,193 deaths occurred in the rainy season of 122 days; 4,805 in the hot and dry season of 61 days; 6,870 in the cold season of 121 days; and 2,811 in the hot and damp season of 61 days.

Out of 220 rural circles or tálukas, 201 were more or less affected by cholera. In 58 rural circles the death-rate from cholera exceeded 12 per 1,000 of population. The disease principally prevailed in nine tálukas of each of the Thána and Khándesh collectorates; in five of each of the Násik, Kolába, and Karáchi collectorates; in four of each of the collectorates of Ahmedabad, Kaira, and Surat; in three of the Broach collectorate; in two of the respective collectorates of Ahmednagar, Sátára, Panch Maháls and Thar and Párkar; and in one of each of the collectorates of Hyderabad and Ratnágiri.

Out of 56 town circles, 51 were affected by cholera during the year. The death-rate exceeded 10 per 1,000 of population in 29 towns, and of these 12 are situated in the Gujarát Registration District, and among them Borsad town, where the death-rate rises to 126·90 per 1,000 of population, heads the number.

The affected area included 8,461 out of 25,143 villages in the Presidency. The highest percentage took place in Karáchi, where out of its 791 villages, 694 or 87·74 per cent. were affected. In Hyderabad, Kaira, Broach, Thána, and Surat the percentages were 66·90, 50·78, 50·12, 47·91, and 43·52, respectively, and in Sátára also out of its 1,343 villages 572 or 42·59 were affected, but in the remaining collectorates the percentages were below 40 per cent.

Small-pox.—There were 9,885 deaths from small-pox (5,198 males and 4,687 females) against 1,946 in 1899 and a decennial mean of 3,024. The mortality is the highest recorded for the past ten years. No district has been free, though some districts have been visited lightly. The Western Registration District shows the highest mortality, 64·35 per cent. of the total deaths, and of the deaths in the district the largest number occurred in the City of Bombay in the early part of the year. Both in the city and in the districts adjacent the outbreak was much increased by the large influx of strangers. In the city fortunately open airy sheds for calves, in a fair situation, are in temporary use, thus the calves were enabled to be kept healthy, and by great exertions on the part of the Superintendent of Vaccination and his staff a very large number of vaccinations and re-vaccinations (over 34,800 in three months) were performed, as the chief outbreak was in the first quarter of the year.

As regards the deaths from small-pox in the Southern Registration District, the Deputy Sanitary Commissioner, Southern Registration District, remarks that "small-pox caused 752 deaths in the whole circle as against 439 last year, which was largely due to difficulties of vaccination work in affected plague localities"; and as regards the deaths from small-pox in Gujarát, the Deputy Sanitary Commissioner, Gujarát Registration District, states that "considering the enormous influx of people from surrounding States during the famine, the number of deaths from small-pox is not large, and testifies to the good work done by vaccination staff."

According to age 28·86 per cent. of the small-pox deaths occurred amongst infants under one year of age, whilst 41·20 per cent. took place among children one to ten years, the remaining 29·94 being among persons over 10 years of age.

Fever.—There were 543,319 deaths registered under the heading "Fever," excluding plague (288,145 males and 255,174 females), against 228,438 in 1899, thus there was an increase of 314,870 deaths as compared with the previous year; the decennial mean is 382,332, which includes the deaths from plague for the past four years. The number of deaths registered from fever is the highest for the past ten years. The death-rate was 28·87 per 1,000 as compared with 12·14 for the previous year and a decennial mean of 20·57, and this includes the deaths from plague during the years from 1896 to 1899. In the Gujarát Registration District the death-rate was very high. In the collectorates of Poona, Dhárwár and Kánara the ratio was nearly the same as that for 1899. The collectorate of Panch Mahál heads the list with a very high ratio, 167·77 per 1,000, against 21·44 in 1899, and 23·26 in the previous ten-year mean. In the collectorates of Ahmedabad, Broach, Thar and Párkar, Kaira, Khándesh and Surat high ratios are observed. This result is due to famine causes to a great extent.

As regards the enormous increase in the number of deaths from fever in each collectorate in Gujarát, the Deputy Sanitary Commissioner, Gujarát Registration District, remarks that "three-fifths of the total number were returned from Ahmedabad and Panch Mahál Districts. The returns from these two districts show serious defects in registration, and fever as a cause of death is much too commonly entered. The highest recorded number of deaths from fever in any month was in May, which is a very unusual occurrence, and may be partly accounted for by the fact that in this month also the cholera epidemic reached its greatest virulence and many deaths from cholera were entered under the heading of 'Fever.' Still, a form of fever was unusually prevalent early in the year and continued throughout the hot weather. A careful watch was kept for symptoms pointing to relapsing fever, but no cases were observed, and during the hot weather a careful investigation, conducted by Captain Lamb, I.M.S., in Broach, Kaira, Panch Mahál, and by myself in Ahmedabad District, produced no evidence of this disease. It was not confined to famine workers or the poorer classes. The better classes suffered considerably in Ahmedabad City. This type of fever continued up to the fall of the rains and was quickly followed by the usual type of malarial fever, which became quite an epidemic among a people reduced in condition by a year's famine. The rain was scanty and ceased early, and malarial season attained full vigor in August and September, fully a month before the usual time."

As to the increased number of deaths from fever over that for 1899 in Sind, the Deputy Sanitary Commissioner, Sind Registration District, remarks that "the severity of the incidence was most marked in the Thar and Párkar District. The increase is attributed to the large number of famine refugees in this district, their bad state of health, and the altered conditions under which they were living."

Plague.—At the end of 1896 there had been a total of 2,909 attacks and 2,086 deaths from plague, 61,093 attacks and 46,944 deaths were recorded during 1897, 110,369 attacks and 86,191 deaths during 1898, 126,287 attacks and 96,596 deaths during 1899, and 43,064 attacks and 33,196 deaths in 1900. The incidence of this disease has been very much less in the year under review than in the two previous years. In every circle, except Karáchi, the attacks and deaths have been very much lower than in the previous year. Whether this is due to the waning of the disease, the less severe measures, inoculation, non-registration of plague deaths or the numbers of those liable to plague having been reduced from other causes such as famine, remains to be seen. The table below gives the progress of the disease by months in each collectorate for the year under report. The epidemic continued throughout the year and was at its lowest intensity in July and reached its maximum in October. Five districts, Broach, Panch Mahál, Thar and Párkar, Shikárpur and Jacobabad remained uninfected throughout the year.

No.	District.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.		Total.		Number of Towns and Villages affected by Plague.
		Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	
1	Khándesh	1	1	7	3	—	2	—	—	—	—	—	—	—	—	—	—	1	1	1	1	—	—		—	10	8	4
2	Násik	37	26	69	56	42	35	2	2	1	—	—	—	—	—	52	30	450	373	56	756	168	131	11	11	1,688	1,420	27
3	Thána	171	142	230	181	356	300	471	397	265	243	46	34	38	32	163	123	290	249	197	173	76	76	99	96	2,402	2,046	51
4	City of Bombay	2,455	1,718	3,023	2,491	4,067	3,125	3,092	2,367	1,511	1,141	603	421	405	268	383	270	626	357	638	380	451	283	659	464	17,913	13,285	1
5	Kolába..	52	45	15	11	20	13	15	14	27	23	3	4	—	—	—	—	21	5	20	10	—	—	24	15	197	140	35
6	Ahmednagar..	44	43	34	30	41	31	37	31	—	—	—	—	—	—	1	1	6	6	8	4	2	1	—	—	173	147	9
7	Poona	120	109	42	34	54	49	13	12	1	1	—	—	3	3	206	150	1,539	1,273	2,881	2,353	928	836	299	266	6,086	5,086	86
8	Sholápur	615	566	293	208	120	101	2	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1,030	877	22
9	Sátára	186	144	107	91	83	70	30	32	12	8	—	—	—	—	—	—	7	5	25	15	49	23	84	36	583	424	56
10	Ratnágiri	92	56	86	45	106	106	69	62	14	12	5	3	—	—	—	—	—	—	3	3	—	—	—	—	375	287	52
11	Belgaum	284	225	180	149	148	101	77	67	32	18	15	7	42	32	284	203	1,556	1,114	1,829	1,205	1,295	964	756	562	6,498	4,647	93
12	Dhárwár	429	375	247	210	186	166	40	35	—	—	1	1	—	—	1	1	300	188	477	380	242	190	189	135	2,112	1,681	77
13	Bijápur	159	128	56	48	1	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	216	178	26
14	Kánara..	4	2	—	—	4	—	2	1	1	—	2	3	8	3	14	9	28	25	33	26	28	18	5	5	129	92	6
15	Surat	54	51	27	23	37	26	17	12	6	4	1	1	23	13	52	36	68	55	45	39	28	21	29	16	387	297	17
16	Broach..	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17	Kaira	†	5	†	3	†	7	†	3	†	6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	†	24	3
18	Panch Mahás	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
19	Ahmedabad	—	—	—	—	—	—	—	—	†	14	†	14	†	1	†	1	—	—	—	—	†	1	—	—	†	31	3
20	Karáchi	68	57	81	64	640	451	1,807	1,436	533	405	35	33	—	—	—	—	—	—	—	—	—	—	—	—	3,164	2,446	16
21	Hyderabad	3	2	25	12	55	46	17	18	1	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	101	80	3
22	Thar and Párkar	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
23	Shikárpur	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
24	Jacobabad	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total for the Presidency ..	4,774	3,695	4,522	3,659	5,960	4,631	5,691	4,491	2,404	1,877	711	521	519	352	1,156	824	4,892	3,651	7,013	5,345	3,267	2,544	2,155	1,606	43,064	33,196	587

† Not available

Khándesh.—This district was very lightly affected. There were 10 attacks and eight deaths in four villages.

Násik.—The plague prevailed in a mild form up to May, when it ceased, the greatest mortality (56) being in February, It reappeared in August with 30 deaths, and rapidly increased with 373 deaths in September and 756 in October ; after this it declined just as rapidly, and the year closed with 11 deaths in December. In all there were 27 towns and villages affected, and 1,688 attacks and 1,420 deaths.

Thána was affected during the whole year as in 1899. In January there were 142 deaths from plague, and the disease gradually increased until April, when the maximum number of deaths, 397, took place, and then gradually declined until July, when 32 deaths took place ; it then again increased during the months of August and September, when 249 deaths were recorded in the latter month and again gradually declined, and the year closed with 96 deaths in December. There were 51 towns and villages affected with plague, recording 2,402 attacks, and 2,046 deaths.

Bombay City.—As in 1899 the disease was prevalent throughout the year. The maximum deaths, 3,125, were reached in March, when it rapidly fell until July, giving 268 deaths, the minimum, and then again there was a gradual rise, and continued so until the close of the year, when 464 deaths were recorded. The total for the year was 17,913 attacks and 13,285 deaths.

Kolába.—There was plague in a mild form in Kolába for nine months. The highest mortality, 45, took place in January. In all there were 35 towns and villages affected, and 197 attacks and 140 deaths.

Ahmednagar.—In January there were 43 deaths, and decreased gradually till April, when it ceased. The district was practically free until the end of the year. The totals for the year were nine towns and villages, with 173 attacks and 147 deaths.

Poona.—In the Poona collectorate plague occurred in all the tálukas except Junnar. In January there were 109 deaths, after which they fell rapidly until in May, and the collectorate was free in June. There were a few cases in July. In August there was a large and sudden increase in the mortality, and continued to increase till October, when 2,353 deaths, the maximum, were recorded ; 86 towns and villages were affected, and there were 6,086 attacks and 5,086 deaths reported.

Sholápur.—The disease was on the increase during the latter part of 1899, and recorded the maximum deaths, 695, in December, but in January there was a fall, which continued until April, when only two deaths were recorded, and the district remained free till the close of the year. The totals for the year were 22 towns and villages, 1,030 attacks and 877 deaths.

Sátára.—In January there were 144 deaths, after which they fell rapidly until in May, when 8 deaths were recorded, and the collectorate was free up to the end of August. The disease reappeared in September, and continued to the end of the year with a few deaths each month. In the whole collectorate 56 towns and villages were affected, and there were 583 attacks and 424 deaths.

Ratnágiri.—In the first half of the year plague prevailed to a limited extent, while the latter half, with the exception of three deaths in October, was free. The highest mortality (106) was in March. There were 52 towns and villages affected, and 375 attacks and 287 deaths occurred.

Belgaum.—As in 1899 the disease was prevalent during the entire year. In 1900 the minimum deaths took place in June, but from that month it began to increase till October, when the maximum (1,205) was recorded. Ninety-three towns and villages were affected, and there were 6,498 attacks and 4,647 deaths reported.

Dhárwár was affected during the whole year except in the months of May and July. The year opened with 375 deaths in January, and the disease gradually declined till April, when the minimum, 35 deaths, was recorded ; it again increased rapidly, when the maximum, 380 deaths, was reached in October ; 77 towns and villages were affected, and there were 2,112 attacks and 1,681 deaths reported.

Bijápur.—In January there were 128 deaths, after which they fell rapidly until in March, when two deaths were recorded, and the collectorate was free till the close of the year. The total for the year was 26 towns and villages, 216 attacks and 178 deaths.

Kánara.—With the exception of February plague was present in a mild form throughout the year. There were six towns and villages affected, and there were 129 attacks and 92 deaths.

Surat.—In this collectorate the plague was present in every month of the year. Amongst town circles the highest number of deaths, 128, was recorded in the town of Bulsár. In all there were 17 towns and villages affected, and 387 attacks and 297 deaths.

Broach.—There was no plague in this collectorate.

Kaira.—This district was very lightly affected. There were 24 deaths in three towns and villages.

Panch Maháls.—There was no plague in this collectorate.

Ahmedabad.—In this collectorate, Dáskroi Registration Circle returned nine deaths, while 22 deaths were reported from Ahmedabad Town Circle.

Karáchi.—The increase which took place towards the close of 1899 continued in January with 57 deaths and 64 in February, when it rapidly increased, recording the maximum mortality, 1,436, in April, and declined just as rapidly as it increased. The disease ceased in June, and the district was free till the close of the year. Karáchi Town Circle suffered the most during the year. In the whole collectorate 16 towns and villages were affected, and there were 3,164 attacks and 2,446 deaths reported.

Hyderabad.—In the first half of the year there were a few deaths from plague, but the latter half was free. There were three towns and villages affected, and 101 attacks and 80 deaths reported.

In the whole Presidency there were 43,064 attacks and 33,196 deaths from plague, and 587 towns and villages were affected, as compared with 126,287 attacks, and 96,596 deaths and 2,256 affected towns and villages in 1899.

The parts most affected were City of Bombay, the Collectorates of Poona and Belgaum, and the rates of plague deaths per 1,000 in them were 16·48, 4·80 and 4·60 respectively. Karáchi came next with a rate of 4·36, and then Thána, Násik, Dhárwár and Sholápur with rates which ranged from 2·50, 1·69, 1·60 and 1·16 respectively; the rates of the remaining affected collectorates were much lower. The rate per 1,000 for the various registration districts were as follows:—

Western 3·74, Central 1·35, Southern 2·00, Gujárat ·11 and Sind ·88.

In January there were 3,695 deaths, and during March they rose to 4,631. In April the deaths fell, and continued to fall until the minimum (352) was reached in July; they rose again in August, and a more distinct rise took place in October, when the maximum 5,345 was recorded, after which they continued falling until December.

Dysentery and Diarrhœa.—Dysentery and diarrhœa caused the deaths of 119,877 males and 98,366 females, or a total of 218,243 persons, against 74,736 in 1899, and a decennial mean of 46,568; an increase of 143,507 against the last year, and 171,675 over the decennial mean.

The deaths ascribed to dysentery and diarrhœa during the eight years preceding 1897 showed only slight variations, but have since 1897 shown a great increase. In the famine year of 1897 there was a sudden increase, which is but natural in a year of scarcity, and has been repeated to an even greater extent in the present year.

The Deputy Sanitary Commissioner, Gujarát Registration District, remarks that "these diseases prevailed from the beginning of the year, and only sensibly declined during the last two months. They were most prevalent during and just after the rains, when damp and chills were added to the chief cause—unsuitable food. The consumption of badly cooked, half-cooked or raw grain, wild seeds, leaves, bark of trees, roots, &c., in fact of almost anything solid which would help to fill the void; these are the chief causes of what was really an epidemic of dysentery and diarrhœa. The famine has brought to light many new kinds of grain as food, chief among which are the endless varieties of grass seeds. At first there were two chief varieties, Samo and Ankhi-Manki, the former being obtained only from Bir land or regular grass land, while the latter is ubiquitous. Later any patch of grass was shaved close to the ground and the ground carefully swept, and the miscellaneous collection of seeds ground to a meal and eaten as cakes. It is astonishing how many hundreds of people have been able to keep body and soul together on a diet of grass seed cakes, yet considering the proportion of indigestible and irritating husk

to nutrient material in the tiny seeds, a purely grass seed diet must at any rate at first have had very deleterious effect. The consumption is so large now that the collection of grass grain has almost become an industry."

Injuries.—During 1900, 4,740 males and 3,484 females, or a total of 8,224 persons, met with violent deaths. The mortality from these causes is more by 1,112 than that reported in 1899. Of the 8,824 deaths 3,637 occurred from drowning, 984 from wounding, 955 from snake-bite, 203 from hanging, 107 from poisoning, 121 from attacks by wild beasts, and 2,217 from other causes.

Other Causes.—The recorded deaths from causes other than those specified number 342,027, of which 180,698 occurred among males, and 161,329 among females. The total for 1899 was 254,872, so there is an increase of 87,155. Under this heading all deaths are included which cannot be classed under cholera, small-pox, fever, plague, dysentery and diarrhœa, or injuries. The numbers have been increasing since 1890, and much more rapidly from 1896, and it is due—

(1) To improvement in registration so that now more attention is paid to the cause of death, though considering the agency there is room for further improvement.

(2) To plague, which has made registrars careful not to put too many cases down to "Fever," which attracts attention and enquiry.

(3) And this year to famine causes.

Sanitary Works.

During the year ending 31st March, 1900, there were 165 municipalities in the mofussil with a population of 2,196,359 souls: the total income of these municipalities, including balance in hand on 1st April, 1899, amounted to £459,667. Out of this sum £97,180 were expended on improving the water-supply, drainage and conservancy within municipal limits.

There are 23 District Local Boards with 205 Táluka Local Boards: the entire income of these Boards during the year ending 31st March, 1900, amounted to £302,862, and out of this sum £21,497 were expended on water-supply, drainage, and conservancy.

The Bombay Village Sanitation Act of 1889 has been introduced into 301 villages, or one more than the number last year. It would appear that owing to famine and plague, which claims the attention of the District Officers, no progress has been made in the establishment of village committees under the Village Sanitation Act.

Apparently no further progress has been made in the number of selected villages in which the Village Sanitary Inspection Book has been introduced, as the number stands about the same as it did last year, and this is due to famine and plague. The number of villages where the inspection book has been written up by the Sanitary Department stands at 543 against 359 of the previous year.

Personal Proceedings and General Remarks.

At the beginning of the year Lieutenant-Colonel O. H. Channer, M.B., D.P.H., I.M.S., was acting as Sanitary Commissioner for the Government of Bombay up to the 20th April, 1900. During that time he inspected in the Broach District the Poor-house, the Reservoir Work, and the Ashta Famine Relief Work; in Poona, the Poor-house and the Moshi and Girchwad Ramshet and Karkala Camps; in Ahmednagar, the Poor-house and the works at Kaparwadi, Chas, and Warulwadi; in Sholápur, the Poor-house and the Hotgi and Kondi Kegaon Works; in Bijápur, the Poor-house and the Sangogi Relief Camp and Bádámi; in Násik, the Poor-house, the Kirdi Sathe, Wasali, and Odal Works, and in Khándesh the works at Chálisgaon and Mehanbhara, and also the Collectorates of Belgaum and Dhárwár. On April 21st, 1900, I took over charge upon return from leave, and as the conditions in Gujarát were then very serious, I went up to Ahmedabad in May and inspected the works about there to enquire into the cause of the high mortality, and also Nádiad, A'nand, Thásra, and Dákor; in June, Godhra, Dohad, Mehmedabad, Broach, and Surat were visited. In September, the Ahmednagar collectorate was visited and seven

relief works inspected ; in October the Sholápur Collectorate was visited, and in December I toured in Násik and Khándesh to ascertain the famine prospects and what medical relief was likely to be needed.

Many towns were visited in the course of the inspection tours, and though the expenditure on famine was heavy, and no sanitary measures of importance save those having connection with famine works were in progress, the general cleanliness was fairly well maintained.

The famine has been reported on, and a great deal of information regarding the public health during the time is contained in the previous sections and in the appendices of this report. It may as well be stated that the rains appeared late and ceased early, and owing to this famine conditions continued to the end of the year, though not so severely as in the previous year.

As has before been stated, it is not so much the quantity of rain that falls as the way in which it falls, which is productive of the greatest benefit to the country.

In the Western Registration District the collectorates affected were Khándesh and Násik above Ghâts and Thána below. The climatic conditions were coldness in the first part of the year, followed by a rather greater heat than usual in the hot season. The rains fell much later than usual, but the fall was not evenly distributed, and their early cessation in September ruined prospects of the late crops, and this was the condition throughout the Deccan generally.

In the Central Registration District the collectorates of Poona, Sátára, Ahmednagar, and Sholápur were affected. In this group the climatic conditions were much the same. Cold weather in the early part of the year, with a hot season somewhat hotter than usual, and a rainfall not well distributed and ceasing early to the detriment of the late crop, and so relief, but not on such a large scale, had to be continued. There was immigration from Native States into Sholápur and Ahmednagar and to a less extent into Poona, but the people being hardy and thrifty and accustomed to famine conditions from the year 1897, the death-rate per 1,000 of population did not reach to twice the normal rate of the previous five years.

In the Southern Registration District the collectorates of Bijápur and Belgaum suffered from famine conditions. In Bijápur just over 50 per cent. of the population were affected, the climatic conditions were much the same as in Sholápur, and the percentage of relief was in January 1·05 of the population affected. All the relieved being workers, by the end of April the numbers amounted to 6·62, of which 4·74 were workers. Then the numbers on relief gradually declined, till near the end of November the percentage was 1·07, of which 0·65 were being gratuitously relieved. The prices of jowári and bájri were in January $22\frac{1}{2}$ and $20\frac{5}{8}$ lbs., in May $21\frac{5}{8}$ and $20\frac{1}{4}$ lbs., and in December $24\frac{1}{2}$ and $25\frac{1}{2}$ lbs. to the rupee, contrasted with an average of $45\frac{2}{8}$ lbs. jowári and $39\frac{1}{8}$ lbs. bájri in the year 1898.

The Gujarát Registration District was very seriously affected by famine. The collectorates of Ahmedabad, Broach, Kaira, and the Panch Maháls suffered throughout their entire area, and in Surat, though the famine was not so severe, 75 per cent. of the population were affected. The climatic conditions were cold in the early part of the year with a wide variation between the maximum (day temperature) and the minimum (night temperature), and to this, no doubt, was due some of the increased mortality which began to show itself in this part ; but it was not the sole cause. Then the hot weather came on, and it was hotter than usual and accompanied by a very strong hot wind blowing up clouds of dust which made it hard work for the people to fulfil their tasks. The rains set in late, practically not till July, and after September they ceased, so that famine conditions still continued, but, fortunately, the conditions were not so severe, as there was a large growth of wild grasses on the seeds of which the people supported themselves.

Immigration from surrounding Native States took place to a large extent, especially into the Panch Maháls and Ahmedabad, and these wanderers getting into poor condition before reaching relief helped to swell the mortality. No correct estimate of their numbers can be furnished, and they soon learnt to avoid stating where they came from. The mortality in all the Gujarát Districts was very high, and the causes are briefly—

(1) The practice of not storing grain, so that when their food was suddenly restricted they supplemented it with deleterious and indigestible substances.

(2) Clinging to their houses on this insufficient food to look after their cattle, and then, when the cattle died, coming on to the relief works in an impoverished condition, and then, being dissatisfied with the wage they were able to earn, wandering away again.

(3) The large influx of people from Native States. Many coming in in poor condition.

(4) The cold weather at the end of the year, and then the heat which prevailed throughout Gujarát accompanied by a hot wind.

The amount of relief given in the various districts in January varied from 1·82 in Kaira, 1·36 in Surat, 5·19 in the Panch Maháls, 6·68 in Ahmedabad to 23·88 in Broach, and this rose by the end of April to 12·68 in Kaira, 3·19 in Surat, 16·55 in the Panch Maháls. 18·78 in Ahmedabad, and 25·15 in Broach. The differences in the percentages relieved in the various districts do not appear to have had any appreciable effect on the mortality, for, leaving out Surat, the death-rate in May for Broach, which had the largest numbers on relief, is the highest in May after the Panch Maháls and Kaira, for the same month, in which district relief was the lowest, had the lowest mortality, though of course that was very high.

Towards the end of the rains, as it was apprehended that, owing to the enfeebled condition of the people, a heavy mortality from malaria might take place, distribution of free medical relief on an extensive scale was organised and continued to the close of the year. This was much appreciated by the people, and was, I consider, beneficial.

In the Sind Registration District the Thár and Parkar collectorate was affected by famine, and there was a good deal of immigration into the principal town, Umarkot, of famine-stricken people who had not made adequate provision for the march across the desert and arrived in such a poor condition as to seriously swell the mortality. The mortality, which in January was over three times the ten years mean, gradually diminished till May, when it was a little over twice the normal. In June a great increase took place, and in July it was eight times the monthly average, and then again declined till in December it was under three times the normal.

In none of the famine-affected districts did the number of births exceed the number of deaths, and a very serious decline from the previous five years' mean can be noted in most of them, due to the privations endured. The majority of the deaths have been ascribed to "Fever", and it was so wide-spread that a sharp watch was maintained for relapsing fever, but expert bacteriological research failed to detect it, and although, as our Registrars are not highly educated men, and medical certificates as to the cause of death are seldom furnished, there can be little doubt that many cases were entered under the head of "Fever" which should have been entered under other causes, yet there was a good deal of malaria present to attacks of which people succumbed more readily than at other times.

Cholera was widespread, but the deaths attributed to this are not so many as might be expected, and perhaps this is due partly to deaths being omitted when the outburst was severe and sudden, and partly that in the earlier stages at least the deaths were entered under the heading "Dysentery and Diarrhœa."

Plague did not appear in the famine camps and poor-houses, and did not, except in Poona and Belgaum, obtain much hold in the famine districts.

The deaths from starvation are given for each district in the following table :—

Deaths from Starvation.

Districts.	1900												
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Ahmedabad	261	551	593	660	708	402	468	371	281	349	178	111	4,933
Broach	26	5	10	—	—	—	1	—	—	—	—	1	43
Kaira	4	—	—	—	1	—	1	—	—	—	—	—	6
Panch Maháls	52	97	47	20	12	—	—	—	—	—	—	—	228
Surat	3	1	6	19	38	6	3	2	—	1	1	—	80
Thána	—	—	1	2	—	—	—	—	—	—	—	—	3
Ahmednagar	—	—	1	—	—	—	—	—	—	—	—	—	1
Khándesh	24	—	—	—	—	1	1	1	—	—	—	—	27
Násik	—	—	—	1	—	—	1	—	1	—	—	—	3
Poona	6	2	—	—	—	1	21	12	2	4	—	—	48
Sátára	—	—	—	—	—	—	—	—	—	—	—	—	—
Sholápur	—	—	—	—	—	—	—	—	—	—	—	—	—
Belgaum	—	2	1	—	—	—	1	—	1	—	—	—	5
Bijápur	2	—	—	—	—	—	—	—	—	—	—	—	2
Thar and Párker	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	378	658	659	702	759	410	497	386	285	354	179	112	5,379

Even with the best arrangements such deaths in a widespread and severe famine are to be expected. The largest number of deaths is reported to have occurred amongst wanderers, and the Gujarát district shows the highest figures. Of these deaths by far the largest number took place in and around the town of Ahmedabad. Here there were a large number of wanderers, who objected to go to the poor-house, and when in tried to get out as soon as they could and preferred to beg, and so eventually succumbed. If they had remained in the poor-house, and gathered strength enough to enable them to work, they could have gone to a work and earned a sufficient wage to keep them. The dead were picked up by organised stretcher-parties and brought for examination before burial.

The sanitary measures taken at camps were directed to the preservation of the purity of the water supply, the selection of places for latrines and burial grounds, hospitals and wards for infectious diseases, the proper laying out of camps, and the building of kitchen shelters and poor-houses.

Medical officers as many as were available were placed in charge of camp hospitals and poor-houses, and besides treating the sick they constantly went round the camp inspecting the condition of the people, seeing to the cleanliness of the camp and the water-supply, and when considered advisable disinfecting the wells with permanganate of potash. They also saw that the food and other articles sold in the camp bázárs were good and wholesome. These camps and medical officers were supervised in turn by the District Medical Officer.

The water-supply in most of the Deccan districts was of the usual average quality, and on most of the famine camps and kitchens and poor-houses sanitary precautions were taken to safeguard it and supply it as free from contamination as possible to the people. In Gujarát, however, in certain parts the water is brackish or tends to become so as the hot weather advances. Twenty-one samples were sent for analysis from the various districts of Gujarát and 15 were pronounced unfit for potable purposes. In ordinary times, the people being in good health, do not appear to suffer from the use of the water to which they are accustomed, but with the failure of the rains the yield of water was lessened and it was probably more contaminated than usual, and had more deleterious effect upon a population whose stamina had deteriorated ; but this was a subsidiary cause, just as the effect of cold and heat acting on frames weakened by want of proper food.

It was in many cases impossible to prevent workers taking water from unauthorised sources, or bringing in unwholesome food, and so starting cholera, which when it broke out caused the people to scatter and infect other places. In the hot weather, when the people were getting low and the deaths were numerous, a longer rest was given in the time and the work lightened, and the rule regarding compulsory residence at camps was relaxed. Gratuitous relief was largely expanded during the rains to assist the cultivators in their field operations.

Report of the Sanitary Board for the Year 1900.

Preliminary.—Plague and famine again pressed hard on the municipalities last year ; and we would again draw attention to paragraph 8 of our Report for 1898. Government gave various municipalities considerable grants-in-aid for plague expenditure ; and it is hoped that the financial state of these municipalities will recover this year to some extent.

Sukkur.—The pumping machinery was thoroughly overhauled and repaired, at a cost of £300, which has resulted in one-third of the fuel expenditure being saved. It is proposed to drive a cross collecting gallery, to increase the water-supply in the cold weather, when the large spring in the original tunnel always diminishes as the river falls. It is not understood why the supply of this spring should fluctuate with the height of the river, as the temperature of the former is five degrees, or more, higher than that of the river, and the spring water is much harder, so that it must come from a considerable depth, and apparently from a subterranean source.

Hyderabad.—The new engines at the river lift have been working very satisfactorily and with a very large saving in fuel. Plans and estimates for improved settling tanks, and for a pier to carry the suction pipe out into the river, have been approved of by Government, and sent to the municipality. If Government, in the Military Department, would only pay the arrears due for extra water supplied to the troops (a matter which has now been under discussion for same years, and is believed to have been at last finally settled), the municipality would have funds to start these works. Plans and estimates

for filter beds, a high level reservoir in the Fort, and for covering in the Fort lift reservoir, are still under consideration. The drainage scheme is postponed for want of funds.

Karáchi.—The sewage farm is said to have been more profitable last year; but its management, as a *true* sewage farm, seems to have decidedly deteriorated since the departure of the late Superintendent. There is, apparently, no reason why it should not be as profitable as the Madras sewage farms, if properly managed.

Ahmedabad.—The drainage scheme, prepared by Mr. B. Latham, was practically shelved for over a year, as the Public Works Department Executive Engineer could not spare time to work out the necessary alterations. It has lately been taken up again; but we think that it will be quite impossible for the Executive Engineer to carry out a work of this importance satisfactorily and without recurring delays, in addition to his own heavy work, even if he is given an assistant, who will naturally have had little, if any, experience of such work. A Special Engineer, with drainage experience, should be employed. The sewage farm has much improved under the care and management of the present Superintendent. The municipality have now sent him to study the crop systems at the Surat Government Farm, and the Karáchi Sewage Farm; and as he is an intelligent man, with an interest in his work, he will probably gain valuable information.

Kaira and Mehmadabad.—The plans and estimates for the water-supply projects for these two towns have been prepared by the Sanitary Board, and will be submitted shortly.

Yeola.—The waterworks have been practically at a standstill for over two years, although about half the work had then been done. The Public Works Department Executive Engineer has had no time to push on the work, and the municipality (as is always the case) will not provide the extra taxation for the necessary funds, unless they are specially and continuously urged.

Ahmednagar.—The Kapurwadi Tank was not completed as a famine work before last monsoon, consequently no water was stored over the aqueducts, and the water-supply to the town and cantonment (as anticipated in our reports for the last two years) will probably be a matter of serious difficulty this hot weather. The work is *now* practically done; and the project for completing the distribution in the remaining two-thirds of the town will be sent in shortly. It would be advisable to have a similar system of distribution, under pressure, in the cantonments.

Poona.—The drainage and water-supply projects, prepared by the Sanitary Engineer, were revised in accordance with the advice of Mr. Santo Crimp, and finally approved of by the municipality and by the Government of Bombay. They are now before the Government of India, as they can only be carried out by a loan on liberal terms; this, it is to be hoped, will be given, as the works are very urgent and necessary for the health of both the city and cantonments.

The results of the small sugarcane experiment at the Kirkee Government Farm were confirmed by that at the Manjri Government Farm (the latter being at the site of the proposed municipal farm), and in each case the effluent was found to produce about ten per cent. more sugar than poudrette, which is the standard manure for sugarcane in the neighbourhood of Poona. The Government Agricultural Chemist was deputed to make full analyses of the cane, juice, and soil; and his report may be expected shortly. The experiments are being continued; and it is under contemplation to carry out a large practical test at Manjri on ten acres of land; but this should not delay the early commencement of the Poona Sewerage Works, the urgency of which is shown by the fact that during the first half of last year, when plague was absent from the City of Poona, the death-rate (which has been increasing yearly), was from 50 to 60 per 1,000. The experiments are only to prove how the effluent can be most profitably utilised; but as the drainage scheme will take three years to carry out, this knowledge can be ascertained during that time. If the profits are only half what the small experiments show, there can be no risk to Government; and looking to the heavy yearly cost of the measures for counteracting plague (which the city cannot bear in the future), we submit that even if there was some risk, it would be more than justified, and would probably be cheaper in the end. We would, therefore, most strongly urge that the sewerage works in the city should be commenced at once, leaving the question of the final disposal of the sewage to be settled hereafter. Although such farms have not paid in England, it must be remembered that water is an absolute necessity for cultivation in India, whilst it is only an added difficulty in England.

Sholápur.—We would beg to refer to paragraph 16 of our Report for 1898. Nothing has yet been done towards providing a second pumping engine, and the danger, of course, increases yearly, as the engine is now being worked 50 per cent. more than what it was designed for. The Public Works Department Executive Engineer has not even yet had time to work up the sewage scheme, which is urgently wanted. The source of the water-supply of Sholápur is the Ekruk Tank, from which the water passes to the pumping station by an open channel about $4\frac{1}{4}$ miles long. Naturally, there is great danger of contamination to the water in this channel ; and we would urge the necessity for filter beds at the pumping station, as at Poona, and for the protection to the channel of supply.

Belgaum.—The water-supply project for the town and cantonments, prepared by the Sanitary Board, has been transferred by the Bombay Government to the Madras Military authorities, as the troops are under that Command. The very scanty supply in the wells at present shows the urgent need for such a scheme, as this scarcity is, more or less, recurrent every year. Unless there are early rains the situation will probably become very difficult, if not dangerous, this hot weather, as at Ahmednagar.

Regarding the other towns and projects referred to in our Report for 1898, we can only repeat what we have said in paragraph 10 of our Report for last year.

ABSTRACT OF THE REPORT OF THE HEALTH OFFICER OF THE PORT OF BOMBAY FOR THE YEAR ENDING 31ST DECEMBER, 1900.

The following tabular statement gives a summary of the shipping of the Bombay Port and the work in connection therewith, for the year ending 31st December, 1900 :—

Vessels including Country Craft.	Number of Vessels inspected.	Number of Persons inspected, including Crew on Vessels.	Number of Native Crew and Third Class or Deck Passengers disinfected during the year.	Number of Vessels disinfected.	Number of Persons Vaccinated.	Number of Persons segregated or rejected.	Diseases and Number of Cases of each.					
							Plague.	Cholera.	Small-pox.	Measles.	Chicken-pox.	Jigger.
Entered	156	23,192	5,607	46	2,064	145	11	5	12	3	—	125
Left	65,734	1,149,858	71,555	—	—	17,169	59	2	1,347	19	17	—
In Harbour during the year ...	76	—	—	76	713	—	14	78	33	6	2	—
Total for 1900 ...	65,966	1,173,050	77,162	122	2,777	17,314	84	85	1,392	28	19	125
Total for 1899 ...	65,822	1,193,339	48,349	87	32	17,662	155	1	2	7	7	168

It will be seen that 65,966 vessels of all sorts with 1,173,050 crew and passengers, including those who arrived from certain infected ports, were examined during the year. The clothing and bedding of 71,555 native crew and third class or deck passengers who embarked on vessels for ports out of India were disinfected against the clothing and bedding of 44,864 disinfected during the year preceding. This increase in disinfection work is due to the fact that the luggage of the native crew, deck and third class passengers (with the exception of troops) proceeding to ports out of India was disinfected, whereas for 1899 all native crew's clothing and bedding were disinfected from 13th February 1899 and that of deck and third class passengers from 14th June 1899. The baggage of 987 returning pilgrims, 2,877 deck passengers arriving from Jigger-infected ports and 1,743 crew and passengers of other infected vessels which arrived in Bombay was disinfected. The total number of persons vaccinated was 2,777 against 32 during the previous year, as there were 1,392 cases of small-pox detected at the outward and inward inspections and on board the vessels lying in the harbour during the year 1900. The number of plague cases detected was 84 against 155 for the year preceding. There was an increase of cholera cases, the number being 85, while during the year 1899 there was only one case. There were 125 jigger cases—43 less than in 1899. Most of the rejections at the medical inspections were allowed to return to the city, which accounts for the few cases of plague recorded during the year 1900.

The following table gives details regarding vessels which entered the port during the year:—

Year.	Total Number of Steamers and square-rigged Vessels which entered Bombay Harbour from Ports other than Indian Ports.	Number of Passengers only.	Total Number of Native Sailing Craft which entered Bombay Harbour from Ports other than Indian Ports.	Number of Passengers only.	Total Number of Steamers and square-rigged Vessels which entered Bombay Harbour from Indian Ports.	Number of Passengers only.	Total Number of Native Sailing Craft which entered Bombay Harbour from Indian Ports.	Number of Passengers only.
1900 ...	622	10,562	274	158	1,697	477,116	34,673	21,231
1899 ...	527	25,660	250	484	1,375	309,915	44,267	6,001

As there is no record kept of the crew on most of the vessels entering the Port the numbers are not given in the above table. There were 462 troops, 987 Mecca pilgrims and 507,156 passengers, principally from ports near Bombay, making up the total of 508,605 passengers as compared with 342,060 during the year 1899.

The number of ships which had infectious disease on board on or before entering the harbour is given in the following table :—

Class of Vessels.	Number of Ships.	Total Number of Crew and Passengers inspected.	Number of Passengers from East Africa disinfected on account of presence of Jigger among them, and those from other vessels for infectious diseases.	Diseases and Number of Cases of each.						Number of Persons Vaccinated.
				Plague.	Cholera.	Small-pox.	Measles.	Chicken-pox.	Jigger.	
Troop-ships	—	—	—	—	—	—	—	—	—	—
Vessels from Jigger-infected Ports.	27	4,947	2,877	—	—	—	—	—	125	—
Other Vessels	19	5,236	1,743	11	5	12	3	—	—	2,064
Total	46	10,183	4,620	11	5	12	3	—	125	2,064
1899	32	7,624	2,623	4	—	1	2	7	168	32

Six steamers which entered the harbour had 11 cases of plague at the time of arrival or during the voyage. The cases were sent for treatment to the Plague Hospitals in Bombay, and the effects of the crew and passengers as well as the ships were thoroughly disinfected in accordance with the Venice Convention Regulations. There were five cases of cholera (of which three died) on board the steamer "St. Ninian" during her voyage from Calcutta. Two cases were found on board the steam-ship "Massilia" and were removed to the hospitals on shore. The vessels were thoroughly disinfected. The bilges were pumped dry and cleaned; the drinking-water tanks on board were emptied and disinfected with potassium permanganate solution before they were allowed to be filled with a fresh supply of drinking-water. Eight steamers had in all 12 cases of small-pox and two vessels had 3 cases of measles. All these cases were removed to the hospitals and the ships disinfected. Those of the unprotected crew and passengers among whom small-pox occurred were vaccinated. Enteric fever is not noticed as it is not one of the infectious diseases under the Act.

Out of the 70 vessels with 8,728 crew and passengers which arrived at Bombay from Jigger-infected ports on the South-East Coast of Africa, 27 vessels had 125 persons suffering from Jigger and ulcers due to Jigger at the time of arrival. They were removed to the Gokuldas Tejpal Hospital for treatment. The crew and passengers on infected Jigger-ships had their clothing and bedding disinfected before they were allowed to mix with the general population.

Examination and disinfection of incoming vessels were carried out according to the revised rules issued by Government under their Notification No. 1645–P., dated 13th March, 1900. Accordingly, all arrivals from plague-infected ports, viz., Karáchi, Persian Gulf Ports, Hedjaz, Glasgow, Port Said, Alexandria, Aden, Cape Town, Mauritius, Hongkong, and other Eastern ports were inspected up to the 5th of April,

1900, after which date only "infected vessels" were inspected in accordance with letter No. 2128-P., dated 31st March, 1900, from the Secretary to Government. This letter authorized the Port Health Officer not to inspect "Healthy Vessels" arriving at Bombay from plague-infected ports until such time as the City of Bombay is considered free from plague, which would be for the purposes of this order, when the number of plague deaths reported in the published returns falls below 25 in a week. In the case of infected vessels, Government directed that the passengers and crew need not be detained, if they were apparently healthy; but Rule VIII. (1), (3), (4), and (5) of the new rules—a copy of which is given below—should be carried out, and similarly, in the case of "Suspected Vessels," Rule IX. (1), (2), (3), (4)—a copy of which is also given—should be followed.

Rule VIII.—"Infected Vessels," or vessels so classed, will be dealt with as follows, when Bombay is free from plague, and may be so dealt with at other times at the discretion of the Health Officer :—

(1.) The sick will be disembarked under the directions of the Health Officer and sent to the camp or hospital, whether ashore or afloat, appointed for the purpose.

(3.) The soiled linen and personal effects of the passengers and crew which, in the opinion of the Health Officer, may be considered as infected, shall be disinfected in accordance with the rules contained in the appendix.

(4.) The bilge-water will, after disinfection, be pumped out, and a fresh supply of drinking water will be stored on board.

(5.) All parts of the vessel, which have been occupied or frequented by plague patients, will be disinfected under the supervision of the Health Officer, and any other parts of the vessel may also be disinfected at the discretion of the Health Officer.

Rule IX.—"Suspected Vessels," or Vessels so classed, will be dealt with as follows :—

(1.) Passengers and crew will be medically examined by the Health Officer.

(2.) The soiled linen and personal effects of the passengers and crew which, in the opinion of the Health Officer, may be considered infected, shall be disinfected in accordance with the rules contained in the appendix.

(3.) The bilge-water will, after disinfection, be pumped out and a fresh supply of drinking water will be stored on board.

(4.) All parts of the vessel, which have been occupied or frequented by plague patients, will be disinfected under the supervision of the Health Officer, and any other parts of the vessel may be disinfected at the discretion of the Health Officer.

The following table furnishes the total number of vessels, crew and passengers examined on arrival at Bombay, including the ships with the returning pilgrims from Jeddah, and those which arrived from Jigger-infected ports :—

Months	Number of Vessels inspected.			Number of Persons inspected.							Number of Persons segregated.			Number of Plague cases found on arrival at Bombay.
				Passengers.		Crew.		Total.						
	Number of Steam-ship and Square-Rigged Vessels.	Number of Native Sailing Craft inspected.	Total.	Steam-ship and Square-Rigged Vessels.	Country Craft.	Steam-ships and Square-Rigged Vessels.	Country Craft.	Number of Passengers.	Number of Crew.	Number of Passengers and Crew.	Passengers.	Crew.	Number of Passengers and Crew.	
1900.														
January	18	—	18	863	—	1,884	—	863	1,884	2,747	6	1	7	—
February	33	—	33	1,595	—	3,902	—	1,595	3,902	5,497	18	10	28	1
March	18	—	18	1,256	—	1,926	—	1,256	1,926	3,182	6	—	6	—
April	11	—	11	413	—	1,114	—	413	1,114	1,527	6	—	6	3
May	10	1	11	1,326	6	759	8	1,332	767	2,099	18	1	19	2
June	10	1	11	699	14	873	9	713	882	1,595	26	—	26	4
July	11	—	11	801	—	1,095	—	801	1,095	1,896	9	—	9	1
August	4	—	4	249	—	343	—	249	343	592	1	—	1	—
September	5	10	15	408	16	414	124	424	538	962	—	5	5	—
October	5	3	8	491	10	362	25	501	387	888	2	6	8	—
November	8	1	9	535	—	457	11	535	468	1,003	26	—	26	—
December	7	—	7	512	—	692	-	512	692	1,204	4	—	4	—
Total for 1900 ..	140	16	156	9,148	46	13,821	177	9,194	13,998	23,192	122	23	145	11
Total for 1899 ..	391	807	1,198	41,823	3,037	29,104	2,946	41,860	32,050	76,910	228	10	238	4

Out-going Vessels.

The number of outward bound vessels and the passengers and crew inspected month by month from 1st January to 31st December, 1900, are shown in the sub-joined table:—

Months.	Number of Vessels Inspected.			Number of Persons Inspected.							Number of Persons Rejected.			Number of Plague cases which developed among the rejections.
				Passengers.		Crew.		Total.						
	Number of Steam-ship and Square-Rigged Vessels inspected.	Number of Native Sailing Craft inspected.	Total.	Steam-ships and Square-Rigged Vessels.	Country Craft.	Steam-ships and Square-Rigged Vessels.	Country Craft.	Number of Passengers.	Number of Crew.	Number of Passengers and Crew.	Passengers.	Crew.	Total Passengers and Crew rejected.	
1900.														
January	266	6,860	7,126	55,070	21,007	14,594	53,729	76,077	68,323	144,400	2,500	526	3,026	7
February	245	7,381	7,626	48,447	10,197	10,625	46,623	58,944	57,248	115,892	2,374	221	2,595	9
March	276	7,021	7,297	59,100	5,671	14,209	48,366	64,771	62,575	127,346	3,024	275	3,299	15
April	276	7,692	7,968	55,633	5,313	14,931	51,094	60,946	66,025	126,971	2,804	217	3,021	11
May	274	8,872	9,146	51,139	6,324	14,108	53,029	57,463	67,137	124,600	1,466	138	1,604	4
June	192	2,322	2,514	21,729	2,270	11,459	16,051	23,999	27,510	51,509	495	119	614	1
July	156	1,005	1,161	18,635	2,031	10,201	7,790	20,666	17,991	38,657	238	86	324	4
August	174	1,298	1,472	21,013	2,119	10,421	7,780	23,132	18,201	41,333	228	116	344	—
September	164	3,414	3,578	21,519	3,198	8,341	23,225	24,717	32,066	56,783	93	329	422	—
October	226	5,126	5,352	54,742	4,123	11,945	33,378	58,868	45,323	104,191	1,170	111	1,281	5
November	248	5,895	6,143	49,748	6,089	12,990	37,678	55,837	50,668	106,505	1,398	138	1,536	2
December	258	6,093	6,351	55,856	6,743	13,421	35,651	62,599	49,072	111,671	1,379	89	1,468	1
Total for 1900 ..	2,755	62,979	65,734	512,631	75,088	147,745	414,394	587,719	562,139	1,149,858	17,169	2,365	19,534	59
Total for 1899 ..	2,891	61,703	64,594	503,212	62,937	149,110	401,170	566,149	550,280	1,116,429	16,015	1,409	17,424	117

The medical examination of the crew and passengers of all vessels which left Bombay for ports out of India was carried out by day, on shore, in sheds specially arranged for that purpose. Out of 1,149,858 outward bound crew and passengers inspected, 19,534 or 1·70 per cent. were prevented from sailing. Most of the rejections were turned into the town. The remainder were sent to the Port Observation Camp, where 59 of them developed plague.

Out of 65,734 outgoing vessels, with 562,139 crew and 587,719 passengers examined during the year, 234 vessels with 26,195 crew and 18,756 passengers left for Aden, or ports in the Red Sea and Europe ; 642 vessels with 36,166 crew and 28,319 passengers for other ports out of India, and the remaining 64,858 vessels with 499,778 crew and 540,644 passengers for Indian ports, including Burma.

The disinfection of the clothing, bedding, and any suspected articles of native crew (excluding Japanese crew, who are specially exempt from this operation) and of the third class or deck passengers and native servants who sailed on vessels bound for ports out of India, was carried out as in the previous year at Malet Bandar, where the port health stove was situated, up to 7th September, 1900. On the 8th September, 1900, the stove was removed to the shed specially constructed for disinfection purposes near Prince's Dock, where the kit of the persons mentioned above was disinfected, while the kit of the crew and passengers, who sailed in native sailing craft for foreign ports, was disinfected by means of the municipal sterilizer at the Modikhana Hospital.

The clothing and bedding of 50,452 native crew and of 21,103 third-class or deck passengers were disinfected during the year.

The native crew of vessels proceeding to ports out of India are, as a rule, inspected three times—firstly, before embarking, so as to meet the letter of the Convention ; secondly, when their clothing and bedding are being disinfected the day before they sail ; and, thirdly, just *immediately* before the vessel sails.

The sanitary condition of all outward bound vessels, including native sailing craft, was, as a rule, carefully attended to. All of them were examined and found to be in a satisfactory sanitary condition, and were so certified in the bills of health issued to them. The crew's quarters were painted or limewashed before departure. The 'tween decks and holds of ships in ballast were cleaned before leaving the port, and the 'tween decks of coal ships were thoroughly washed down and in most cases limewashed, or disinfected with a solution of carbolic acid. This was necessary, as the holds of such coal ships are used for the purposes of nature by the coolies, numbering from 500 to 1,000, who discharge the coal. The bilges of native craft were generally clean at the time of inspection ; but those that were found to be dirty or containing filthy water had to postpone their departure until thoroughly cleaned.

Infectious Disease on Vessels in the Harbour.—All the steamers, square-rigged vessels, and native craft which became infected while at sea or among whose crew and passengers plague developed after their arrival in port, also the dock labourers found on vessels and coolies removed to plague hospitals from the docks and bandars are enumerated in the table annexed. All these vessels and those in the second table on page 159 were thoroughly disinfected according to the Venice Sanitary Convention and Indian Ports Act Rules.

Months.	Steamers.									Buggalows, Tonies, Prows, Steam-Launches, &c.									Number of Persons who were attacked with Plague at Bandars and in the Docks.		Total Number of Cases of Infectious Diseases in the Bombay Harbour.							
	Number of Ships.	Cholera		Small-pox.		Measles		Plague.		Number of Native Craft.	Cholera		Small-pox.		Measles		Plague.				Total number of infected Vessels.	Cholera		Small-pox.		Measles		Plague.	
		Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.		Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.		Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
1900.																												
January ..	1	—	—	7	—	—	—	—	—	2	—	—	1	1	—	—	1	1	—	—	3	—	—	8	1	—	—	1	1
February ..	10	—	—	19	—	4	—	—	—	4	—	—	1	1	—	—	4	3	—	—	14	—	—	11	1	4	—	4	3
March .	2	—	—	11	5	—	—	—	—	4	1	1	2	2	—	—	2	2	—	—	6	1	1	13	7		—	2	2
April ..	1	—	—	—	—	1	—	—	—	1	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	1	—	—	—
May ..	—	—	—	—	—	—	—	—	—	6	19	19	—	—	—	—	—	—	—	—	6	19	19	—	—	—	—	—	—
June ..	1	1	1	—	—	—	—	—	—	10	13	11	—	—	—	—	1	1	—	—	11	14	12	—	—	—	—	1	1
July ..	7	7	6	—	—	—	—	—	—	7	7	7	1	1	—	—	1	1	—	—	14	14	13	1	1	—	—	1	1
August .	1	3	3	—	—	—	—	—	—	9	19	17	—	—	—	—	—	—	—	—	10	22	20	—	—	—	—	—	—
September	1	—	—	—	—	1	—	1	1	4	6	6	—	—	—	—	—	—	—	—	5	6	6	—	—	1	—	1	1
October ..	—	—	—	—	—	—	—	—	—	5	2	2	—	—	—	—	2	1	—	—	5	2	2	—	—	—	—	2	1
November	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2	—	—	—	—	—	—	—	2	2
December ..	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total for 1900 ..																					76	78	73	33	10	6	—	14	12
Total for 1899 ..																					80	1	1	1	—	5	—	34	26

Port Observation Camp.—The area of land occupied by this camp from the date of its erection, viz., 16th January, 1899, up to 31st August, 1900, was 25,090 square feet. On 1st September, 1900, the land was curtailed to 17,296 square feet, as such a large space was not required owing to most of the persons rejected having been turned into the town. Among the outgoing passengers and crew, who were sent to the camp, 59 developed plague. They were transferred for treatment to the plague hospitals in the city. All the sheds in the camp were thoroughly disinfected twice a week with the standard solution of perchloride of mercury, and when a plague case was removed to a hospital the shed in which it developed was at once disinfected with a solution of perchloride of mercury and was not used for some time after. One hospital assistant, one ayah, and one sweeper form the establishment of the camp. The services of the latter were not utilized, as the sweeping of the camp was carried out in accordance with arrangements made with the Public Health Department of the Bombay Municipality. One of the senior medical officers was detailed in turn every month to supervise the general working of the camp.

Persons sent to the observation camp were kept there until their temperature fell to normal, or until it was certain that the symptoms from which they were suffering were not due to plague.

Disinfection of Ships and Infected Cargo.—There were 122 infected vessels of all sorts disinfected during the year under the personal supervision of the Health Officer of the Port, or his staff, assisted by the harbour police. Arrangements were made by the Resident Transport Officer and the Senior Naval Officer for carrying out the Port Health Officer's recommendations for the disinfection of marine and naval ships on which cases of infectious diseases occurred.

The steamships "Bisagno," "Raffaelo Rubattino," "Domenico Balduino," "Okara," and "Rajah" landed at the docks and at Carnac Bandar damaged cargo, viz., 320 bags of grain called mug, a large quantity of potatoes, six bags of flour, and two bundles of senna leaves. The superintendents of Victoria and Prince's Docks, the Preventive Department, or the agents of the vessels called upon the Port Health Officer to examine the damaged cargo. Accordingly Officers on the Port Health Staff were detailed from time to time to examine the cargo, who after examination condemned the articles in question and certified them to be either a nuisance or unfit for human consumption.

On six occasions it was found to be absolutely necessary to disinfect infected cargo.

General Health of the Shipping.—During the year 916 persons connected with the shipping were admitted into the various hospitals in the city suffering from ordinary disease. The St. George's Hospital admitted 614 Europeans, of whom 15 died; the Jamsetjee Jijibhoy 83 natives, of whom four died; and the Goculdas Tejpal 219 natives, of whom 23 died. The diseases were chiefly due to ague, beri beri, syphilis, rheumatism, diarrhœa, cholera, small-pox, measles, bronchitis, &c. The Medical Inspector of the Royal Alfred Sailor's Home reported one case of plague, which occurred among the family of the Superintendent of the Home. There were no cases of any other infectious disease in the Sailors' Home.

The Coroner of Bombay held one inquest on a man who died from the effect of mephitic gas and 21 inquests on persons who died from accidents other than bilge poisoning on board ships.

Red Sea Pilgrim Traffic.—During the year 987 pilgrims returned from Mecca *via* Aden by four vessels. The ss "Naderi," with 448 pilgrims from Jeddah, which arrived in this harbour on the 11th of May, 1900, landed a case of plague at Aden and had five deaths from natural causes during the voyage. According to the rules laid down regarding an infected pilgrim ship, all the pilgrims were kept under observation for 10 days before being allowed to proceed to their homes up country and beyond the frontier. The well-to-do and influential persons, who travelled first-class on the vessel, were allowed to pitch their own tents and use their own furniture in the port health camp.

The baggage of all returning pilgrims was disinfected in the Port Health Disinfecting Stove. Pilgrims whose homes were up-country or beyond the frontier were not allowed to enter the town, but were sent direct from the ship to their homes by rail at the Government expense. The pilgrim traffic from Bombay to Jeddah has been stopped owing to the prevalence of plague in the former place since the year 1897, and consequently no vessels with Mecca pilgrims left this port for Jeddah during the year.

Emigration Traffic.—There was no emigration traffic this year as it has been suspended since the year 1897, owing to the prevalence of plague in the City of Bombay.

Sanitary state of the Harbour and Foreshore.—Owing to the pressure of work the usual close inspection of the harbour and foreshore was not made during the year.

Epidemic of Cholera, Small-pox, and Plague.—20,577 persons are admitted to have died in the city from plague, cholera, and small-pox during the year, viz., cholera 4,273, plague 13,286, and small-pox 3,018. Plague and small-pox existed in a virulent epidemic form from January to May inclusive, while cholera raged from June to September inclusive.

At the commencement of the outbreak of cholera in the city there were 19 deaths in the month of May among the crews of the native craft which lay at Malet, Carnac, and Modi Basins. These craft bring vegetables, fruit, and other fresh supplies for the Bombay market. Some of these basins are foul at low water, as the municipal sewers containing nightsoil discharge into the Carnac and Modi basins. Government ordered a bacteriological examination of water in these basins in their Resolution No. 3338, dated the 26th June, 1900. Accordingly 12 samples of sea water from the Carnac Basin and Modi Bay were sent for analysis to the Director-in-Chief, Plague Research Laboratory, Government House, Parel. The result of the examination by Professor Haffkine has been reported to Government in this office letter No. 2429, dated the 19th September, 1900. Professor Haffkine's opinion is quoted *verbatim*, as follows:—

> The two rather important features, viz.:—
> (1) In the faculty of a peptom culture turning red when mixed with a strong acid and

(2) of a suspension of bacilli being clumped under the effect of the serum of an immunised animal. The comma bacilli cultivated from water samples Nos. 5 (Middle of Carnac Basin), 6 (Harbour end of Carnac Basin), and 11 and 12 (about 100 yards of sewer discharging into Modi Basin) showed themselves different from typical comma bacilli isolated from cholera patients.

They may thus be either degenerated cholera microbes having lost the above two faculties, or else micro-organisms belonging to the same tribe of comma-shaped bacilli as the cholera microbes.

Our experience up to the present leads us to the conclusion that such non-cholera commas (?) are to be found only in places where cholera exists; and if they really belong to species in themselves harmless from the point of view of that disease, they at any rate indicate the presence of conditions favourable to the life and development of the cholera species of comma-shaped bacilli.

A water or locality containing such microbes ought consequently to be pronounced dangerous to the surrounding inhabitants.

Nightsoil has now ceased to be discharged into the basins and the Port Trust has arranged for the dredging of them.

The rigorous nature of the examination enforced on each individual who left this Port, combined with the disinfection of the clothing and bedding of all native crew and third class and deck passengers bound for ports out of India, lessened to a considerable extent the number of suspiciously ill persons presenting themselves for medical examination owing to the fear of being detained. For this reason very few fully-developed plague cases were found at the time of inspection.

Whenever any of the crew or passengers who were prevented from sailing on a vessel bound for a foreign port developed plague, the fact was communicated to Government, with a view to telegraphic intimation being given to the authorities at the first port of call. In cases where plague occurred among persons prevented from sailing on vessels bound to an Indian port, the fact was notified by the Port Health Officer to the next port at which the vessel was due to call.

With the exception of two (British India Steam Navigation Company and Hall Line) no lines of vessels that left Bombay met with any vexatious delay owing to quarantine regulations at foreign ports. This speaks volumes for the faith of Foreign Governments in the efficiency of the measures adopted by Government to prevent the spread of plague from Bombay by sea.

During the year 59 persons affected with plague were not permitted to sail on outgoing vessels; 14 persons, on inspection, were found to be plague-stricken on vessels and native craft in the harbour, docks, and bandars; and 11 cases occurred on vessels on or before arrival at Bombay from other infected ports, making a total of 84 plague cases in connection with the harbour.

There is a falling off in the number of plague cases detected during the year as compared with previous years, but this is due to the fact that most of the rejections during 1900 were turned into the town and were, therefore, lost sight of, while in 1898 and 1899 the rejections were kept under observation for some time in a camp. In addition to the plague cases 85 cholera and 1,392 small-pox cases were detected during the time that these diseases raged in an epidemic form in Bombay. The majority of the cases were among native passengers, and were detected at the medical examinations which take place on shore prior to the embarkation of crew and passengers.

Plague has unfortunately broken out at foreign ports, but in no instance can the outbreak be traced to the crew or passengers on vessels from Bombay. The all-important question of infection by cargo or rats was carefully considered by the late Plague Commission, but no satisfactory conclusion was arrived at. The fact that plague has broken out at various ports, only among people who worked cargo or who resided near the docks, would tend to show that the outbreaks were due to cargo or possibly rat infection.

Plague in India continues to be of the bubonic type, and so long as it continues so, there is a probability that foreign and European ports where the people wear boots or shoes will escape being attacked by a virulent and wide-spread epidemic of bubonic plague.

ABSTRACT OF THE REPORT OF THE CALCUTTA MUNICIPALITY FOR 1900-1901.

(*R. T. Greer, Esq., Chairman.*)

Health.—The excess of deaths over births and the large immigrant population in Calcutta are noticeable features. In the opinion of the Health Officer the large number of immigrants, mostly unvaccinated, tend to the encouragement of the periodical recurrence of epidemics of small-pox and the importation of cholera. After making allowance for the increase in the population, and possibly defective registration of deaths, there is reason to believe that the general mortality has been progressive, in spite of the various measures which have been taken to improve the sanitation of the town. Insanitary dwellings and over-populated buildings in congested areas are the chief factors in this result. The main hope for improvement lies in the opening out of the town by wide streets, and the enforcement of the Building Regulations to check the further erection of insanitary dwellings. Any effective scheme for the construction of main thoroughfares for the improvement of the health of Calcutta must necessarily be drastic, and involve a heavy expenditure. The limited resources of the Corporation are taxed at present to a considerable extent by the necessity to carry out the important main drainage schemes, and the supply of a continuous water-service. The public are awaiting the action of the Government in assisting the Corporation in this vital work for the health of the city.

The completion of the main drainage works should bear fruit in the immediate improvement of the health of the large population of the suburban area where the surface drains are at present a standing danger. Unfortunately operations have been checked in one important section for a reconsideration of the plans, and some delay is inevitable.

Births and Deaths.—The birth-rate for the year is shown as 12·7 per 1,000, the death-rate being 43·5. Many births apparently escape registration, though the number is not so great as these figures would seem to indicate. It is hoped that the scheme for the reorganisation of the work of the Health Department will bring about an improvement under this heading. The year was unhealthy, an exceptional heavy fall of rain in September inducing an outbreak of cholera, while an increase appears in fever and bowel complaints and plague. The infant mortality is remarkable, amounting to 748 to every 1.000 births registered amongst the Muhamedans in the town area, and to 443 per 1,000 of children under one year of age throughout the city. Early marriages and the insanitary conditions of life are the main causes assigned for these lamentable statistics.

Excepting during the abnormal floods in September, there was nothing unusual in the incidence of cholera during the year. A difference of opinion exists as to the connection between the rainfall and the disease. The introduction of a continuous service should lead to the correction of any deficiencies in the existing pipes, as well as to the provision of an ample supply of good drinking water for the inhabitants.

The Health Officer considers the period under review to be a bad fever year, and represents the statistics which show a low mortality from this cause to be fallacious owing to wilful misrepresentation to escape the suspicion of plague and its attendant consequences. His remarks regarding the influence of the water-supply and drains in the causation of malarial fever are interesting (*see* page 172).

Sanitation.—359 service privies were connected with the sewers during the year, a comparatively small advance when the existing number of the former, 52,701, is taken into consideration. The total number of premises connected with the public sewers at the close of the year was 31,295, 625 having been added in 1900-01.

Sixteen insanitary tanks and 45 wells were filled up during the year. The Health Officer has refrained from strenuous action in this direction in view of the want of a constant water supply. The preliminary steps have been taken to carry out this measure, and a greater improvement may be expected hereafter in removing these insanitary spots.

The work of filling up of wells and tanks calls for continued attention. Outbreaks of cholera are commonly traceable to these sources, while, according to modern theories, malarial fever is largely due to the action of anopheles mosquitoes, which find a suitable breeding-ground in them.

The extention of the unfiltered water supply will tend to clean the surface drains and flush the sewers, and the substitution of connected for service privies will do much for cleanliness and healthy surroundings.

Measures for a general surface drainage system will follow the completion of the main drainage scheme in the locality served by the sewers. No more pressing want exists in the suburban area, as the drainage at present is lamentably deficient.

The Re-organisation Scheme.—The re-organisation of the Engineering, Conservancy and Health Departments was undertaken by a special sub-committee towards the close of the year, and the result will appear in next year's report.

It may be noted that the sub-committee recommend decentralisation, the amalgamation of the Conservancy and Engineering Departments, and the division of Calcutta into four districts, each fully equipped with a district office under a district engineer, health officer and building surveyor.

Street Refuse.—The returns show that 377,848 tons of refuse have been removed during the year, the greater part being carried by train to the Salt-water country, and the remainder being burnt in the Goragatcha Incinerator, or deposited on a dumping-ground at Dakhuria. The work done appears to be in excess of the out-turn of any previous years.

The question of substituting incinerators for the present mode of removal by train has been fully discussed, and the Commissioners have decided to invite tenders on specified conditions for the erection of two incinerators as an experimental measure. Opinion is divided as to the advantages of the present system. The existence of loading platforms on the side of a main road is a constant nuisance to the locality. The transfer of the Municipal Railway line to the canal area has been suggested, the expense being a serious hindrance. The platform near the Campbell Hospital is specially objectionable, and action has been taken to find another site.

The Filtered Water Supply.—Special interest was taken by the Commissioners in the purity of the supply, and in the weekly chemical analysis of the water. Improvements have been carried out at the filter beds in regard to the surface drainage and the cleansing of the filter sand. Arrangements have been made for the systematic bacteriological testing of the filters with a view to checking deficiencies in the beds. A good potable water has been supplied.

The number of bacteria present in the water was comparatively small for the greater part of the year, and increased during the rains. The prevalence of bacillus coli-communis is ascribed to the pollution of the river by storm-water running off the surface of riparian *bustees*. It is impossible to cut off the source of the pollution, and an improvement of the filtering arrangements is the only remedy. The quantity of water supplied during the year amounted to 7,505,096,520 gallons, a daily average of 20,561,908 gallons. The gross cost amounted to 2·64 annas for 1,000 gallons. The daily average pressure at the pumping stations ranged from 66 to 45 feet.

The total mileage of filtered water mains and services amounts to 315 miles, 183 in the town and 132 in the suburban area. 592 feet of 3-inch pipes were laid down, and also four new standposts. Attention has been given to the question of introducing a continuous service. The inconvenience to the public is extreme from the want of a sufficient quantity of drinking water, and action is being taken to prepare a scheme to meet this need. An extraordinary waste at present takes place by leakage from pipes, faulty ferrules, and carelessness in the storage of water. The existing supply from the filter beds appears to be sufficient, but an increase of pressure is required to keep up a constant service, and measures are necessary to check waste. The current year should witness the introduction of the preliminary operations for a continuous service.

Unfiltered Water.—The supply is furnished by two pumping stations at Mullick's Ghât and Watgunge, which provided daily an average of 12,554,794 gallons and 554,596 gallons respectively. The length of the unfiltered main and services amounts to 156 miles; 118 miles in the town and 38 in the suburban area.

Ground-hydrants number 5,680, and there are two bathing-platforms, 56 public urinals, 35 public latrines, and 31 night-soil depôts in connection with the unfiltered water supply system.

Suburban Drainage.—The Engineer considers that good progress has been made during the year in the work connected with the storm-water and sewage outfall.

In the town storm-water outfall a large quantity of earthwork has been excavated from the third section of the reservoir, and the foundation of the outfall sluice has been completed up to its floor-level. The accommodation-bridges, which had been taken in hand during the last financial year were completed in the year under report.

In the suburban storm-water outfall a large quantity of earthwork has been excavated from the reservoir section, and the outfall sluice at Byntolla has been practically completed. One accommodation-bridge has been taken in hand.

The high-level sewer from Palmer's Bridge has been practically finished for a distance of about 2,900 yards, except the syphons and the road-crossings. Half of the High-level Sewer Road has been completed.

About 3,500 feet of the invert of the combined sewage channel have been finished, 910 feet of the sides being completed.

Drainage and Construction.—There is nothing specially noticeable in the work done under this heading, the extent of the operations being comparatively small. 277 feet of underground sewers were completed during the year, 1,246 feet were reconstructed, and 987 feet of surface drains were constructed. 800 feet of kerb and channel stones were set and 608 feet were regraded and reset. 20 sewer man-holes were constructed, and also 7 lamp-holes, and 121 gully-pits. 3 flushing-chambers were made and 4 yard-gullies and 14 bathing-platforms were repaired. 1 ventilating-shaft was erected as well as 2 night-soil depôts. 8 public latrines and 3 urinals were repaired. 1 urinal was constructed and also 1 hackney-carriage stand.

House Drainage.—460 house plans were prepared during the year, and 775 copies were supplied to the public. 625 premises were connected with the public sewers.

Bustee Improvements.—Little progress appears in the work of bustee improvement.

The total expenditure is shown as £2,257, of which £821 appear as compensation for land for roadway, and £1,294 for the construction of roads and sewers in connection with them. The Corporation make liberal grants for bustee improvements, recognising the importance of such measures for the health of the town. The current year should witness a development of these operations.

Model Dwellings.—The question of housing the working classes has received some attention and funds have been provided for the erection of model dwellings for this purpose. The most suitable style of building at present to hand is that which has been adopted by the Bombay Improvement Trust. Two wealthy landowners, Babu Sita Nath Roy and Babu Janoki Nath Roy, have set an example by undertaking the erection at their own expense of one of these buildings on *bastee* land in their possession in the south part of the town, and this work is now in progress. The experiment is an important one, since the demolition of *bastees*, without provision for the occupants, tends to aggravate the evils of overcrowding in the neighbourhood.

The congested state of a large part of the town from ill-constructed and insanitary houses has been recognised by all parties, and there is a general feeling that heroic measures are needed to open up wide thoroughfares bringing light and air to the localities. The Corporation is prepared to undertake its share of liability for this public duty according to its means. The enforcement of the tram-service by the substitution of electric for horse-traction, and the extension of the system should help to remove the labouring population to the suburbs and relieve the congested interior of the town.

ABSTRACT OF THE REPORT OF THE HEALTH OFFICER OF CALCUTTA FOR 1900.

(*Dr. J. Nield Cook.*)

The new census figures show an increase of 161,927, or 23·74 per cent. on those of 1891. The increase is about proportionately divided between males and females. It is principally seen in the town wards, in many of which it is over ten thousand. As there was previously little or no room for expansion in these wards, great density of the population has resulted, the number of persons per acre varying, if we except Waterloo Street, from 111 to 282, the average density of the population of London being 60·9. 282 per acre is equal to 180,480 per square mile. These figures show the extreme importance of dealing with the question of housing the working classes, which will be dealt with in another part of this report. The increase in the population cannot be considered as a natural increase due to the excess of births over deaths, as during the decade there was an excess of 108,153 deaths over births. The increase must therefore be entirely ascribed to immigration. If the decrease in the population due to the excess of deaths over births and the actual increase in the population, as shown by the census figures, be added together, we find that 270,080 more people came into the town than left it during the decade. The fact that Calcutta has such a large floating population affects its public health in many ways. Immigrants are for the most part young adults in search of work. Taking this into consideration in connection with the fact that the female population is comparatively small and consequently the number of children born is small, we have an age and sex population that should give an extremely low death-rate. On the other hand it is probable that many of these immigrants come to the town in an impoverished state and easily succumb to the prevailing diseases, though this is by no means generally the case, and from what I have seen of the labour market in Calcutta every able-bodied man can earn a fair living wage. The large number of immigrants in the town predisposes to the epidemics of small-pox that periodically recur, as many of these country people are unvaccinated and we have been unable to enforce even primary vaccination in the case of adults. Cholèra is frequently imported by immigrants who sometimes form foci for localised outbreaks. The overcrowding and the filthy conditions under which the poor live in a climate that exaggerates the evil effects of insanitary conditions lower the resisting power of the population and favour the spread of infectious disease.

The mortality of the town and suburbs together for the decade just completed and the preceding one cannot be compared as the suburbs were only added in the year 1889. The mortality of the town area from 1881 to 1890, however, averaged 12,056 deaths per annum, whilst that for 1891 to 1900 averaged 15,197, which shows an increase after making all allowance for the increase in the population. The four quinquennial periods into which the last 20 years may be divided give the following average mortalities for the town alone, 12,478, 11,635, 13,721 and 16,673. I cannot avoid the conclusion after making allowance for increase in the population and possibly defective registration of deaths in the past that the mortality has been progressive, in spite of all the work that has been done and the money that has been spent to improve the sanitation of the town. This is only what might be expected, as an insanitary town tends to become more insanitary the longer it is occupied, and this tendency is increase by overcrowding of the population. I am of opinion that nothing short of very drastic measures of sanitary reform involving a heavy expenditure will be of any avail to check this increasing mortality, as good thoroughfares must be made and insanitary areas condemned and cleared as preliminary measures. Three diseases have made their appearance during the decade of which so far as I am aware there is no previous record in Calcutta, Influenza, Cérobro-Spinal Fever and Bubonic Plague. Influenza has spread amongst all classes during nearly the whole of the decade, and has accounted for a considerable number of deaths from diseases of the lungs, particularly pneumonia. Cerebro-Spinal Fever, which

has been shown to be identical with the Cerebro-Spinal Meningitis that occurs in Europe, has occurred principally in jails and emigration depôts. One medical officer informed me that he had seen 106 cases in the last few months, and that most of them ended fatally. Cases have also been recognised amongst the general population, but it is impossible to say to what extent the disease has occurred, as more than half the people die without being seen in their last illness by any qualified medical practitioner, and the disease is not one with which the practitioners generally are well acquainted. My predecessor first reported plague in Calcutta in 1897, but his cases were not accepted by the Government medical officers, so I am unable to say whether they were true bubonic plague or not. I first saw cases of plague in April, 1898, and it has recurred year by year since then with increasing intensity, showing a seasonal prevalence in the early months of the year and nearly disappearing when the rains set in in June. The most hopeful sign about it is that the case mortality is now much lower than it was, a feature that is not uncommon before the disappearance of an epidemic of infectious disease.

Meteorology and the price of food.—Coming to the year of 1900 I find nothing likely to exercise an appreciable effect on the public health in the meteorological conditions until the third quarter, when the floods occurred in the month of September, the rainfall for that month being 45·55 inches against an average of 10·18 inches. The floods were followed by a sharp outbreak of cholera, 255 deaths being registered under that head between the 17th and 30th of that month. A marked increase in the mortality from fevers and bowel complaints is also shown to have followed the floods. There can be little doubt that exposure, chill and want of proper food and means to cook it acted as predisposing causes of disease. A sharp rise in the mortality from fevers and bowel complaints is noticed, and an inquiry that I made showed that there was a considerable increase in the mortality from diseases of the lungs. The weekly death-rate of the whole of Calcutta rose to 82·8 per thousand per annum for the week ending the 29th September, and that of the suburbs to 148·7. The price of food fluctuated somewhat, being higher than the previous year in the 1st and 3rd quarters and lower in the 2nd and 4th.

Births.—The total number of children born exclusive of still-births was 10,773, which gives a ratio of 12·7 per thousand per annum. There is no doubt in my mind that a considerable number of births escape registration, and I do not see how this can be rectified unless the midwives are brought under control by being placed on a register and not allowed to practise unless they are registered, their registration being conditional on their giving information of births in all cases attended by them. At first, as I have recommended on previous occasions, all practising midwives might be licensed and trained ones given a special form of certificate. If no new midwives were registered unless they held a certificate of competent training, in course of time the ignorant midwife would disappear in Calcutta as completely as the Mrs. Gamp type of nurse has disappeared in England.

Deaths.—The total number of deaths was 36,728, which gives a ratio of 43·5 per 1,000 per annum, the average number of deaths for the previous ten years being 22,684. Of the difference of 14,044 plague accounted for 8,354 and suspected plague for a part of the remainder. Making all allowance for this exceptional cause, it is evident that the year was an unhealthy one in Calcutta as it was in Bengal generally. The deaths are shown according to their causes and the localities in which they occurred in the table below. The localities where the highest mortality occurred were Ward 2, Coomartolly, with a death-rate of 51·7, Ward 5, Jorabagan, with a death-rate of 62·8, and Ward 18, Hastings, with a death-rate of 62·6. I am unable to understand the high rates of mortality in Hastings, a considerable part of it being occupied by middle class Europeans. I attributed them to the former census having underrated the population, but the new census makes the population even smaller than before. I have referred the matter to the census officer who has kindly promised to investigate the causes of the decrease in the census population of this quarter. The place compares favourably with most parts of the town and suburbs as regards sanitation, and no serious epidemics have been reported to me as having occurred there. The deaths are registered mostly under fevers and all other causes. The high infant mortality in Calcutta deserves special note. It amounted to 443·2 deaths under one year of age to every 1,000 births. Amongst the Mahomedans in the town area it reached the unheard of figure of 748·6 deaths to every 1,000 births registered. It is for the most part due to the conditions under which the people live being unfavourable to life, and ignorance of infant

hygiene. I believe that early marriage also conduces to it, as when an immature woman marries she frequently brings into the world one or two weakly children. I should like to see the more enlightened natives take up such questions and do something to enlighten their more ignorant countrymen and reform their habits and customs. As regards the marriage question there are signs that public opinion is on the move, though the obstacles to be overcome are great, but so long as the care of the sick is for the most part in the hands of ignorant men and women with no knowledge of rational medicine or nursing, ignorance will take its annual tribute of young lives. During the year there were 443·2 deaths under one year to every thousand births. There is one very noticeable feature about the age groups, and that is the heavy incidence of mortality on the adult population which I can only attribute to the plague epidemic. As usual the death-rates of females of marriageable age are appreciably higher than those of males of the same age. It may be that the female population in these age groups is underestimated from the natural tendency of the oriental to conceal everything connected with his women.

The principal diseases.—The following statement shows the mortality from the principal diseases compared with the average of the previous five years.

Statement of Deaths from different causes during 1900.

1. No. of Wards.	2. Names of Wards.	3. Population according to Census of 1901.	4. Cholera.	5. Small-pox.	6. Fever.	7. Dysentery and Diarrhœa.	8. Plague.	9. Injury. Suicide. Male.	Suicide. Female.	Wounds and Accidents.	Snake-bite or by Wild Beasts.	Total.	10. All other Causes.	11. Total Deaths from all Causes.	12. Ratio of Deaths per 1,000 of Population. Cholera.	Small-pox.	Fever.	Dysentery and Diarrhœa.	Plague.	Injury.	All other Causes.	From all Causes. For the Year.	Mean of previous Five Years.
1	Shampooker	46,850	160	46	341	186	415	4	5	15	—	24	617	1,403	3·4	·98	7·2	3·9	8·8	·51	13·1	38·1	33·3
2	Coomartolly	30,194	176	60	234	150	541	4	2	6	—	12	388	1,561	5·8	1·9	7·7	4·9	17·9	·39	12·8	51·7	33·7
3	Burtollah	50,270	67	77	368	202	510	5	4	14	—	23	682	1,595	3·3	1·5	1·3	4·0	10·1	·45	13·5	40·3	35·6
4	Sukea's Street..	42,126	87	77	367	192	282	5	6	5	—	16	662	1,080	2·0	1·8	8·7	4·5	6·6	·61	15·7	40·1	31·9
5	Jorabagan	49,352	226	122	516	199	1,522	2	4	18	—	24	492	3,107	4·5	2·4	10·4	4·0	30·8	·48	9·9	62·8	32·8
	Mayo Hospital	—	3	—	1	—	—	—	—	1	—	1	16	21	—	—	—	—	—	—	—	—	—
6	Jorasanko	52,857	141	154	461	214	599	9	12	10	—	31	801	2,407	2·6	2·9	8·7	4·0	11·3	·58	15·1	45·4	33·9
7	Burra Bazar	31,672	86	80	282	88	683	—	2	7	—	9	262	1,490	2·7	2·5	8·8	2·7	21·5	·28	8·2	47·0	32·8
8	Colootollah	63,272	133	113	517	220	781	3	1	18	—	22	890	2,676	2·1	1·7	8·1	3·4	12·3	3·4	14·0	42·2	31·6
	Medical College Hospital ..	—	0	—	9	19	23	1	—	10	—	11	142	214	—	—	—	—	—	—	—	—	—
9	Moocheepara	63,558	137	53	543	227	435	5	4	15	—	24	1,010	1,921	2·1	·83	8·5	3·5	6·8	·82	15·8	38·2	33·7
	Police Hospital	—	3	—	1	2	—	—	—	—	—	—	1	7	—	—	—	—	—	—	—	—	—
10	Bow Bazar	27,005	63	20	216	99	237	1	—	5	—	6	351	992	2·3	·71	7·9	3·6	8·7	·22	12·9	36·7	31·9
11	Puddopooker	27,941	95	21	188	113	124	1	1	10	—	12	341	894	3·4	·75	6·7	·40	4·4	·43	12·2	31·9	33·7
12	Waterloo Street	6,340	20	4	48	11	23	—	—	2	—	2	41	149	3·1	·63	7·5	1·7	3·6	·31	6·4	23·5	14·9
13	Fenwick Bazar	31,146	49	49	196	99	550	—	1	11	—	12	293	1,248	1·5	1·5	6·2	3·1	17·6	·57	9·4	40·2	22·3
14	Taltollah	32,253	52	37	302	145	342	—	—	9	—	9	537	1,424	1·6	1·1	9·3	4·4	10·6	·27	16·7	44·1	31·6
15	Collinga..	16,831	11	8	185	72	95	2	1	3	—	6	241	618	·65	·47	10·9	4·2	5·8	·35	14·2	36·7	29·4
16	Park Street..	6,214	15	—	28	8	24	—	—	2	—	2	44	121	2·4	—	4·5	1·2	3·8	·32	7·0	19·4	14·8
17	Bamun Bustee	5,494	8	1	50	17	29	—	—	2	—	2	71	178	1·4	·18	9·1	3·0	5·2	·36	12·9	32·4	47·6
18	Hastings	4,467	12	1	109	31	31	—	—	5	—	5	91	280	2·6	·22	24·4	6·9	6·9	1·1	20·3	62·6	39·0
	Military Hospital	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total	587,842	1,054	923	4,962	2,294	7,246	42	43	168	—	253	7,973	23,374	2·8	1·5	8·4	3·9	12·3	·46	13·5	43·0	33·1
	Fort William	4,588	7	—	66	7	2	—	—	5	—	5	19	106	1·5	—	14·3	1·5	·43	1·0	4·1	23·1	6·7
	Port of Calcutta	25,573	109	1	58	17	—	1	—	49	—	50	26	261	4·2	·03	2·2	·66	—	1·9	1·0	10·2	6·1
	Grand Total ..	618,003	1,770	924	5,086	2,318	6,248	43	43	222	—	308	8,018	23,741	2·8	1·5	8·2	3·7	11·5	·53	12·9	41·5	30·6
19	Entally	38,647	183	40	645	197	244	3	2	12	1	18	602	1,929	4·7	1·0	16·6	5·0	6·3	·46	15·5	49·9	37·6
	Campbell Hospital	—	54	17	178	742	53	—	—	6	—	6	745	1,795	—	—	—	—	—	—	—	—	—
20	Baniapooker	28,294	97	4	435	198	125	—	1	4	—	5	530	1,394	·34	·14	15·3	6·9	4·4	·17	18·7	49·2	33·8

Statement of Deaths from different causes during 1900—continued.

1. No. of Wards	2. Names of Wards.	3. Population according to Census of 1901.	4. Cholera.	5. Small-pox.	6. Fever.	7. Dysentery and Diarrhœa.	8. Plague.	9. Injury. Suicide. Male.	Suicide. Female.	Wounds and Accidents.	Snake-bite or by Wild Beasts.	Total.	10. All other Causes.	11. Total Deaths from all Causes.	12. Ratio of Deaths per 1,000 of Population. Cholera.	Small-pox.	Fever.	Dysentery and Diarrhœa.	Plague.	Injury.	All other Causes.	From all Causes. For the Year.	From all Causes. Mean of previous Five Years.
21	Ballygunge and Tallygunge	27,189	103	4	281	104	67	3	—	11	1	15	454	1,028	3·7	·14	10·3	3·8	2·4	·55	16·6	37·8	41·9
22	Bhowanipur	49,632	229	10	458	214	243	1	2	10	—	13	748	1,915	4·6	20	9·2	4·3	4·8	·26	15·0	38·5	32·7
	General Hospital	—	8	1	5	4	—	—	—	1	—	1	26	40	—	—	—	—	—	—	—	—	—
	Shumbu Nath Hospital ..	—	—	—	9	4	—	—	—	3	—	3	24	45	—	—	—	—	—	—	—	—	—
	European Lunatic Asylum	—	—	—	1	1	—	—	—	—	—	—	1	3	—	—	—	—	—	—	—	—	—
	Alipur Lock Hospital ..	—	—	—	—	1	—	—	—	—	—	—	2	3	—	—	—	—	—	—	—	—	—
	Do. Jail Hospital ..	—	8	—	3	8	—	—	—	2	—	2	23	43	—	—	—	—	—	—	—	—	—
	Do. Police Hospital ..	—	1	—	4	4	—	—	—	—	—	—	3	12	—	—	—	—	—	—	—	—	—
	Do. Police Case Hospital	—	—	—	—	—	—	—	—	1	—	1	216	4	—	—	—	—	—	—	—	—	—
23	Alipur	17,757	74	3	103	59	29	1	—	8	—	9	575	492	4·1	·16	5·8	3·3	1·6	·50	12·1	27·7	28·9
24	Khidderpur and Ekbalpur	21,570	68	1	192	111	109	—	—	8	1	9	447	1,066	3·1	·04	8·9	5·1	5·0	·41	26·6	49·4	38·0
25	Watgunge and Garden Reach	37,952	146	6	232	157	236	1	—	11	1	13	4	1,238	3·8	·15	6·1	4·1	6·2	·34	11·6	32·6	31·4
	Total	221,041	1,078	118	2,971	1,997	1,472	11	6	96	4	117	5,185	12,938	4·3	·38	11·0	8·1	5·0	·42	19·9	49·7	41·2
	Canal	4,443	13	—	10	4	—	—	—	2	—	2	1	30	2·9	—	2·2	9·0	—	·45	·22	6·7	12·1
	Grand Total ..	225,484	1,091	118	2,981	2,001	1,472	11	6	98	—	119	5,186	12,968	4·3	·38	11·3	8·0	4·9	·43	19·5	48·9	41·0
	Combined Total ..	843,487	2,754	1,010	7,642	4,126	8,354	52	48	320	4	405	12,418	36,709	3·2	1·1	9·0	4·8	9·9	·51	14·7	43·5	31·6

Cholera.—The rise in the spring closly followed the mean of the previous five years, and may be regarded as a seasonal rise. The rise in June was due to a large influx of pilgrims from the *Rath* festival at Puri. The opening of the new railway facilitated the importation. The sharp rise in September was connected with the floods. It occurred principally in the suburbs, and I believe that it was due to flood water getting into the mains. This is the only occasion on which I have traced a connection between an outbreak of cholera and the use of the filtered water supply for drinking purposes. The general history of an outbreak is that a number of cases are imported from some place of pilgrimage, the water of a tank or tanks, or it may be a well, becomes infected, as can be shown bacteriologically, and infects some of the people living round who use it for bathing, washing vessels and plates, and perhaps for other domestic purposes. As soon as the source is discovered a police guard is placed over the infected supply, and that particular localised outbreak comes to an end in a few days, though similar outbreaks may have started elsewhere. So it goes on sporadically, and the severe general epidemics characteristic of infection of a public water-supply are now unknown in Calcutta. It occurs mostly in the outlying parts of the town where tanks and wells abound. The water of the Hooghly river and of the canal that surrounds Calcutta are sometimes found to contain cholera vibrios, and at such times cases are found to occur amongst boatmen and others using that water.

Plague.—This disease having been taken out of the scope of my administration as Health Officer will be dealt with by the Special Health Officer appointed to administer it.

Diarrhœa and Dysentery.—The exciting causes of these diseases are still obscure. The course of their seasonal prevalence generally closely corresponds with that of cholera. This may be due to the similarity of their predisposing causes and also to deaths from cholera being registered under this head.

Fevers.—The bulk of the cases in which death is registered under this head are malarial, but the class includes many other diseases in which a high temperature occurs, such as typhoid, influenza, pneumonia, and not improbably some febrile diseases yet unclassified. It will be impossible to ascertain even approximately how many people die

from true malarial fever so long as the majority die without being seen by any one capable of making a correct diagnosis. I have had it in mind for some time past to apply the spleen and blood tests in several of the poorer parts of the town to get a further indication of the prevalence of malaria, but have postponed it as the people are still inclined to look upon anything new as an occult plague measure designed for their injury. It would appear from the chart and tables that the mortality from fevers was below the average. I believe this to be fallacious, for when plague operations were commenced in the town the registered fever mortality fell considerably and that under all other causes rose in a more or less proportionate degree; and this has continued ever since, pointing to wilful false registration to prevent the suspicion of plague and consequent inquiries, and perhaps disinfection. The mortality from fevers has shown a marked increase not only in Calcutta but in other large Indian towns since the introduction of a fairly abundant water-supply. This is easy to account for on the modern theory of the causation of malarial fever through the instrumentality of the mosquito, as the daily introduction of a few million gallons of water provides pools and places where the air is cool and moist during the hot dry season, conditions eminently favourable to the existence of that pestiferous insect, and drainage operations have not as a rule been commensurate with the introduction of water into the towns. As evidence of this I may mention that I have not unfrequently found anopheles breeding in the waste water from stand-pipes. They also breed in the hot weather in small tanks containing much organic matter and vegetation that abound in the outlying parts of the town, being only partially kept down by the fish and tadpoles which prey upon them. With the advent of the rains they become much more generally distributed over the town in rain water pools or puddles. In a few instances in which cases of fever occurred in good European houses larvæ were found in close proximity. I received abundant evidence all over the town that the year under review was a bad fever year, and this was confirmed by the medical officers in charge of large hospitals and public institutions. It was especially prevalent in the neighbourhood of the docks. The Port Commissioners and Messrs. Bird and Company wrote to me complaining that the work of coaling was seriously interfered with by an epidemic of fever among their coolies. I visited the place and found these coolies to be housed in good cooly lines and supplied with filtered water. Their immediate surroundings were clean. The fever was distinctly malarial. The cause of this prevalence of malarial fever was easily traced, for a stagnant ditch was found to run the whole length of the lines at a distance of a few feet from the huts, and the water of this ditch contained abundance of anopheles mosquito larvæ. As the fully developed insects hatched out they would naturally go straight into the huts, feed on the blood of fever cases, become themselves infected and transmit the infection to previously healthy persons. Messrs. Bird and Company on my suggestion procured same barrels of tar with which the ditch was treated under my direction. The action of the tar was not altogether successful, though it undoubtedly destroyed large quantities of larvæ and so limited the production of mosquitoes. The results as regards the prevalence of fever amongst the coolies were disappointing, as for a month the average daily number of cases showed no diminution. Indeed, immediate results cannot be expected in such cases, as the mosquitoes that have been bred will live for several weeks in the huts or houses and the incubation of malaria before symptoms appear is generally not less than a fortnight and may be longer: moreover, a chill or overfatigue will induce an attack for a long time after the parasite has gained admittance to the body if the patient is not thoroughly cinchonised. In two months the fever cases were reduced to half what they were when the experiment was tried, and the coolies themselves said that the fever was much less. Before the floods fever was particularly bad in a bustee near the docks known as the Noolpara bustee, so much so that the people got much alarmed at the heavy mortality. The bustee was low and ill-drained and I found anopheles larvæ swarming in every rain water puddle. The floods came and washed nearly all the anopheles larvæ out of the town. I visited the bustee shortly afterwards, and the people imformed me that the fever had practically disapeared.

Small-pox.—Small-pox no longer causes the very severe epidemics in Calcutta that it did in the past, but it accounts for far more deaths than should be possible in a properly vaccinated town, the principal reasons for this being the imperfect registration of births, the floating character of the population and that vaccination is not compulsory until the second year of life. It presents a cyclical curve attaining its maximum every five or six years, after which it subsides through most of the people who are susceptible and who have not been protected by vaccination or by a previous attack becoming immunised by

an attack of the disease. The last severe outbreak was in 1895, when it accounted for 2,220 deaths, the attacks being in all probability five or six times that number. The curve is now again reaching its highest point, the deaths in 1900 reaching 1,010. Judging from the severity with which it has prevailed during the first quarter of 1901, which is the period of its greatest seasonal prevalence, the number will be higher this year. There is a great tendency to conceal the cases. In 1900 with 1,010 deaths, only 1,598 cases were discovered. As the case mortality from small-pox never has been anything like 64 per cent., it is apparent that a large number of cases escape discovery with its resulting disinfections and vaccination of contacts, and the disease has every chance of spreading. In cases where the patient has no proper accommodation, he is removed compulsorily to a hospital. The parts of the town most affected were Ward 5, Jorabagan, Ward 6, Cooloolola, and Ward 8, Jorasanko. In consequence of the extra work entailed in making inquiries to discover cases, disinfecting premises and vaccinating contacts and any others who were willing, with the consent of the Chairman and Commissioners, my staff was temporarily strengthened by the appointment of 5 disinfecting gangs, each consisting of a Sub-Inspector and 5 men, and 3 male and 3 female Vaccinators.

Prevention of disease.—It is evident from what I have written that there is in Calcutta an enormous waste of life from preventible causes. The means of prevention are in most cases sufficiently obvious, but there are two obstacles in the way of carrying them out. One is the want of money and the other is ignorance combined with prejudice. Thus, in the case of cholera, all that is required is to extend the filtered water supply and cut off all sources of impure water by filling up tanks and wells. But many of the tanks, of which I suppose there are 1,000 or more in Calcutta, are owned by comparatively poor men who have not the means to pay the cost of filling them. Even if they were all willing to comply with our notices and had sufficient money, it would be a matter of great difficulty to find the earth required for the purpose, unless a canal was dug in the neighbourhood of Calcutta, and a light railway constructed to bring in the earth dug out. As regards plague I reported before the first case appeared in Calcutta that isolation, segregation, and disinfection, could not be carried out in such a way as to be effective in a large Indian town, and that the only measures which afforded a prospect of success were the extermination of rats, by preference by inoculating them with a disease non-pathogenic to man, and prophylactic inoculation. It is more than three years since I made this recommendation, and I see no reason to modify it: indeed, I do not think that the town will be free from the pest until the people have sufficiently overcome their prejudices to accept one or both these measures. As regards small-pox, it is well known that it has disappeared in European countries in proportion as vaccination has been enforced. The same result would follow here if we could persuade every man, woman, and child to be vaccinated. But in this case it is ignorance and prejudice rather than want of funds that opposes us, and there is every reason to anticipate that this obstacle will gradually fade away if vaccination is zealously but judiciously pushed. It is now accepted by nearly all medical men who have seriously studied the subject that the so-called malarial fever is an infectious disease or group of diseases caused by animal parasites in the blood which are conveyed from the sick to the healthy by the mosquitoes known as anopheles, these parasites being sucked up with the blood to multiply in the body of the mosquito and gain access to his salivary glands, and finally to be injected into the blood vessels of a fresh human host. Bearing this in mind it will be seen that preventive measures to be successful must more or less follow the following lines which have now been laid down:—

(*a*) The early treatment of cases as they occur with quinine and methylene blue, which have a specific action in destroying the parasites in the amœboid stage of their development before they reach maturity.

(*b*) The isolation of cases in mosquito-proof houses or curtains to prevent the mosquitoes gaining access to them and becoming infected.

(*c*) The use of curtains by the healthy in order to prevent themselves being bitten and infected by mosquitoes.

(*d*) The filling up of tanks and excavations where anopheles mosquitoes breed, levelling the ground and improving the surface drainage.

So far as Calcutta is concerned, the first and third of these measures will only be adopted by a comparatively small number of people. The fourth and last measure is then the only one which offers any real prospect of relief. I believe that an active policy on these lines backed up with sufficient funds by the Commissioners would in a few years' time considerably reduce the prevalence of anopheles mosquitoes in the town and the

mortality from malarial fever. In course of time I should not be at all surprised if even the poor people came to realise the connection between mosquitoes and malaria, and blocked up the openings of their huts at night with pieces of muslin net. I have indeed occasionally seen a rudely made mosquito curtain over the charpoy or bed in a native bustee hut. So far as regards the prevention of malaria among Europeans, it has recently been shown by Stephens and Christophers that they are much less liable to contract the disease if they live at some distance from the huts occupied by natives. This is an additional reason for clearing the bustees in the Chowringhee area and making provision for the occupants elsewhere.

From the above remarks it will be apparent that apart from the fluctuations in mortality that occur everywhere, but more markedly in an insanitary tropical town, I believe that the causes of the high mortality in Calcutta are of a more or less permanent character, but are to a great extent preventible by appropriate measures efficiently carried out. I am of opinion that the opening up of the town by broad thoroughfares, the better housing of the people, the abatement of overcrowding, which is impossible until proper provision is made for housing the poor, the filling up of tanks, wells, and all places where water can stand, completing and improving the drainage, and extending the supply of filtered and unfiltered water are the measures indicated, and that until considerable progress has been made in carrying out these measures any improvement that may be made in the conservancy of the town, the abatement of nuisances, and the control of food supplies will have comparatively little effect in reducing the mortality. Unfortunately these measures would involve so large an expenditure as to be far beyond the borrowing power of the Corporation, and such measures as the Commissioners have hitherto been able to undertake have only been partial and ineffectual. At a recent meeting of the Legislative Council of His Honour the Lieutenant-Governor of Bengal it was stated by the Secretary to Government, Municipal Department, that Government had in hand a scheme for opening up the town with wide thoroughfares at a cost of about 9 crores of rupees. Such a scheme properly carried out should effect a great improvement in the public health and facilitate other sanitary measures.

Vaccination.—The reorganisation of the Vaccination Department on the lines recommended by me and adopted with some modifications by the Commissioners was partially carried out, a better class of men being brought into the Department as vacancies occurred. The total number of vaccinations done during the year was 27,374, the largest number that has ever been done in Calcutta, except in 1895, when a severe epidemic of small-pox occurred. The number of primary vaccinations was 15,210, of which 14,570 were children. This is the largest number of primary vaccinations done in Calcutta in any year. As the number of primary vaccinations is considerably larger than the number of births registered in the town, there can be no doubt that most of the children born in the town are vaccinated, though as we cannot take any action to enforce vaccination until the completion of the first year it results that most of the children are vaccinated somewhat later than is generally the practice elsewhere. The percentage of success in primary vaccination excluding the unknown was 95·0. I believe that this low figure was due to the inferior quality of the lymph supplied at times from the Government Animal Vaccine Depôt, as with glycerised pulp obtained from the Depôt of the Madras Municipality in 133 cases my vaccinators obtained 100 per cent. successful. In the interests of the town vaccination I think it is desirable that the Calcutta Municipality should have its own animal vaccine depôt, as the Madras Municipality has. The percentage of success in revaccinations was 44·6. As I have pointed out on previous occasions the manner in which vaccination is carried on in Calcutta leaves much to be desired. Instead of the calf being placed on a special table frequently washed with disinfectants, it is thrown on the ground in a porch, verandah, or room used for a variety of other purposes, as no funds have hitherto been provided for doing the work in proper style. Considering that vaccination is compulsory, I am of opinion that it should not be carried on in a way to disgust people, but that neat depôts should be constructed in different parts of the town that could be kept clean and aseptic, that appropriate tables should be provided for the calves, and accommodation for the people awaiting their turn. A good deal of the vaccination done now is done in the bustees with lanoline paste. This has its advantages for the bustee people generally are so casual that no amount of threatening or prosecution will induce them to bring their children to a depôt at a stated time. Babu Janmejay Chowdry, B.A., L.M.S., who was appointed Deputy Superintendent in charge of the Vaccination Department, did good work and infused some energy into his vaccinators, fully justifying his appointment.

The filtered water supply.—Under Section 243 of the new Municipal Act the Chairman

is required to test the purity of the filtered water once every week, and to lay the result before the General Committee. Great interest was shown by the Commissioners in the weekly reports giving the chemical analysis of the water, and I was asked to add weekly bacteriological examinations to supplement the chemical analyses. As the Commissioners wished for a comparison with the other Indian drinking waters, the Municipal Chairmen of several large Indian towns were asked to send reports showing the analysis of their drinking water, and several were received, from which I was able to report that the water-supply of Calcutta compared favourably with that of other large Indian towns. An examination of the analysis of the filtered water for a number of years shows that the total solids, hardness, and chlorides are considerably greater in amount during the dry season than during and immediately after the rains, which I attribute to the much greater dilution with rain water which occurs during the latter season, when flood water passes rapidly off the surface instead of percolating slowly through the soil. With the exception of August, when traces of it were found, the water contained no free ammonia during the year. The albuminoid ammonia varied from ·0024 to ·008 parts per 100,000. The water contained no nitrites, and the quantity of nitrates was small. So, chemically, the water may be pronounced a good potable water. During a great part of the year the number of bacteria present in the water did not exceed 100 per cubic centimetre, but during the rains they increased enormously, so as to be on some occasions uncountable. I attributed this to the filter beds, which in the dry season would run for six weeks or so without being cleaned, becoming rapidly clogged during the rains with an adhesive deposit which did not settle in the settling tanks, so that they had to be cleaned about every six days, and were never in use long enough to become thoroughly efficient bacteriologically. During the rains we also found that bacillus coli communis was present in the filtered water. It was found in the river water, the settling tanks, and the outlet wells of the filter beds. As this bacillus is commonly taken as a danger signal shewing pollution of a water-supply I was asked to give a full report on the matter, and attributed its presence to storm-water running off the surface of riparian bustees and carrying it into the river, where it found conditions suitable for its multiplication ; as it did not appear practicable to cut off the sources of pollution, our only prospect of freeing our water from its presence lay in improving our filtering arrangements. This bacillus has continued in the water ever since, all through the dry weather following the rains, and I have also found it in the Howrah water-supply taken from the other side of the river. Mr. Silk, Sanitary Engineer to the Government of Bengal, and also a member of the General Committee, and I were then asked to make suggestions for improving the water-works, which we did. Our principal recommendations were that cattle should be excluded from the compound, that the sand taken from the filters be washed with filtered water in mechanical washers instead of with unfiltered water with coolies walking about in it and stirring it up with *kodalies* which is the present practice, and that the filters be worked by head which as a rule should not exceed three and should never exceed six inches. Mr. Silk also suggested systematic bacteriological testing of all the filters, so that any bed which was found to be letting too many bacteria through could be put out of work. The General Committee held a meeting at the water-works, where everything was explained to them, and subsequently accepted our recommendations. To carry out the last recommendation I proposed that the Medical Officer at Pulta should be trained in making cultures in the Municipal Laboratory, that a room be fitted up for him at Pulta with the necessary apparatus, that all the material be prepared in the Municipal Laboratory, and sent down to him in a box with duplicate keys, and that he should make cultures from the 36 filter beds, two from each at a time, twice a week and send them in the box to the Municipal Laboratory where the estimation would be done. These proposals were accepted by the General Committee, and will be carried out as soon as the apparatus required is obtained. The Medical Officer has already been trained in his work.

Besides the filtered water, 51 samples of Hooghly river water, and 50 samples after settling, and 46 samples from tanks and wells which it was proposed to require the owners to fill up, were chemically analysed in the laboratory by the two analysts to the Corporation, and altogether 239 samples of water were examined bacteriologically. Cholera vibrios were found in 19 samples of tank and well water, but never in the filtered water supply, though it was tested for them every week.

ABSTRACT OF THE REPORT OF THE MADRAS MUNICIPALITY FOR 1900-1901.

(*Lieutenant-Colonel G. M. J. Moore, President.*)

Births and Deaths.—During the year 1900 the total number of live births registered in Madras City was 20,672, against 18,220 in 1899. The ratio per 1,000 per annum calculated on the census population of 1891 was 45·6, against 40·2 in the previous year. This is the highest number of births ever recorded in this city. The number of still births registered during the year was 536, a proportion of 2·5 still births to every 100 born alive. The male births numbered 10,615 and the female 10,057, giving a proportion of 105·5 males to every 100 females.

Population.—The provisional census figures obtained fulfil the expectations felt at the time of writing under the above heading in last year's report. It was pretty certain that the census of 1901 would show an increase and that increase could only be due to immigration. The calculation based on the annual rate of increase per unit of population during the decade 1881–1891 gave the probable number of the population in March, 1901, as 513,300 persons. The enumeration showed this to be in excess of the real number by 3,900, so the rate of immigration during the two periods 1881–1891 and 1891–1901 may be taken to have been about the same, since the difference between the actual and the estimate is fully accounted for by the excess of deaths over births during the latter period by 4,409. There was an excess of births over deaths during the period 1880–1890 of 354 and the census of 1891 showed an increase of 53,741 over the census of 1881. The excess of deaths over births during the period 1890–1900 was 4,409, and the census of 1901 showed an increase of 56,879.

Census.	Males.	Females.	Difference.
1871	194,676	202,876	F. + 8,200
1881	200,170	205,678	F. + 5,508
1891	225,817	226,701	F. + 884
1901	257,298	252,099	M. + 5,199

Madras is slowly, very slowly, conforming to the rule of rising towns. The female population, once in excess, is now in defect on account of males being attracted to the town to work in shops and factories. The more factories there are started in the town the greater disproportion may be expected, until the time comes when women also will begin to labour with their hands, as men do. Then the excess of males will tend to be reduced, and the numbers of the sexes to be more equalised. With the decrease in the proportion of women a concomitant decrease in the number of births must be looked for; while the influx of presumably strong and healthy young males must have a certain influence on the death-rate which cannot be entirely neglected. Compared, however, with the enormous disproportion seen in towns like Bombay, that of Madras seems almost infinitesimal, and it may be well thought that a total disregard of it will not lead to serious errors in conclusions based on uncorrected figures.

Mortality.—During the year 1900 there were 20,937 deaths registered in Madras, with a ratio of 46·2 per 1,000 calculated on the census population of 1891, against 17,248, or a ratio of 38·1 in the previous year, the average for the decade being 18,477·8. Out of

the 20,937 deaths registered, 10,610 occurred among males and 10,327 among females, giving a proportion of 102·7 to 100. The number of deaths according to nationality was, Europeans, 98 ; Eurasians, 433 ; Native Christians, 891 ; Hindu, 17,182 ; Mahomedans, 2,328 ; and others, 5. The ratios per 1,000 are 35·7 among Christians, 41·8 among Hindus, 43·7 among Mahomedans, and 8·4 among "others," against 30·4, 38·6, 40·5, 6·7 of the previous year.

During the year under report the number of deaths from fevers was 5,898 against 3,317. Fevers have reached the usual level. The deaths from measles were 280 against 291 in the previous year, and from dysentery and diarrhœa 2,842 and 566 against 3,000 and 520 respectively. The deaths from small-pox were 46 against 34 ; from cholera, 632 against 23 ; and from plague four imported cases against four.

Statement of Mortality from the prevalent diseases in 1900 *contrasted with that of* 1899.

Years.	Plague.	Small-pox.	Measles.	Fevers.	Dysentery and Diarrhœa.	Cholera.	Total.	Other Causes.	General Total.	Ratio per 1,000.
1899	4	34	291	3,317	3,520	23	7,189	10,059	17,248	38·1
1900	4	46	280	5,898	3,408	632	10,268	10,669	20,937	46·2
Average for 10 previous years	1·3	51·2	444·6	5,765·5	2,971·4	456·4	9,690·4	8,787·4	18,477·8	40·8

Mosquitos and Malaria.—Anopheles mosquitos have now been found in all the eight municipal divisions. It was judged to be a futile task to attempt to catalogue all the collections of water within municipal limits in which the larvæ could be found, since those already known cannot yet be dealt with ; but incidental observations have been sufficiently numerous to justify the assertion that wherever a suitable collection of water exists, whether it be a tank, well, pool, or swamp, there will anopheles larvæ be found at some period of the year. A large number of mounted specimens of fully developed mosquitos of both genera which were caught in Madras, supplemented by a collection received from the District Medical Officer of the surrounding district of Chingleput, were taken to England to be classified and named by Mr. Theobald, but his list has not yet been received.

Later on a further batch was sent to Lieut.-Colonel Giles, I.M.S., for a similar purpose, but no news as yet come from him either.

Although A. larvæ were to be found so easily, it was extremely difficult often to find the winged insect in native houses in the day time, though in one or two European houses and in the Madras Club they could be obtained almost as often as required. Coach houses where hack bandies are kept were the surest find, and if the insides of the bandies were searched between six and eight in the morning, before they were taken out for the day, a fair number of gorged females could often be caught in test tubes.

Though a considerable number of wild females thus caught were dissected between September, 1900, and March, 1901, not a single one was found to contain the developing parasite either in the stomach or the salivary glands. This only bears out the conclusion arrived at on other grounds, namely, that only a small percentage of the female anopheles flying about can possibly be dangerous. The medical officers in charge of the three general hospitals on request were kind enough to send the approximate addresses of some of the patients admitted with enlarged spleens and undoubted malaria. The actual residences of as many of these as possible were traced out, and the surroundings examined with a view of accounting for the attacks. In comparatively few instances, however, was the source of infection indicated by finding breeding places for the larvæ on the premises in the shape of a pool or unused well, but in a certain number the source was obvious. In a town, at any rate, it does not appear to be necessary that the breeding place should be very close, for anopheles can be, and actually are, transported in closed carriages for many miles during their torpid state in the day time. They will cling tenaciously to the cloth-lined interior of a brougham, notwithstanding the jolting, for a drive of three or four miles in the morning, and may be still found in *situ quo ante* after returning home in the evening. On one occasion a particularly torpid individual was

carried about for several hours in an Elwood topi on the owner's head ; it did not stir when the topi was carelessly thrown on a table, and only flew away when poked up towards evening after a further journey on the head of the owner of the topi. Theoretically, therefore, persons living in ordinarily healthy localities can be infected by the bite of a mosquito which has been by some means transported several miles. Such accidental attacks would probably only be mild ; and it is only when severe chronic cases which are suffering from the effects of repeated infections are met with that the cause must be looked for locally. It need not be in the very house, a single unused well containing garbage will supply enough anopheles to infect people here and there in several of the adjoining streets. It is not necessary either that the actual number of anopheles flying about should be large enough to annoy or even attract the attention of the people residing there. In fact, in the narrow wells found in houses and courtyards large numbers of larvæ can seldom be obtained. A successful dip may produce half-a-dozen, but even with three or four dips the total catch may only be one or two larvæ. If large numbers are wanted the pools and swamps in open country must be visited. Here they can be bottled at the rate of 100 a minute with ease.

As was mentioned in last year's report it is probable that the local opinion, which credits the introduction of pipe water into the town with an increase in the amount of fever, is correct in its conclusion, though faulty in its premises, since a large number of wells, which were formerly in daily use and were kept clean, are now abandoned to the mosquitos in favour of the more convenient tap in the wall.

Prophylaxis.—Madras contains, more or less, 18,600 wells.

"*Table of used and unused wells by Divisions.*"

Divisions.	Used.	Unused.
1st Division	2,346	84
2nd „	4,121	252
3rd „	2,370	110
4th „	125	38
5th „	1,796	330
6th „	412	131
7th „	3,789	291
8th „	2,256	200
Total	17,215	1,436

Those classified as unused are probably used on occasions. So to exterminate the mosquitos in the thickly populated parts, where wells are their only breeding places, it is obvious that all wells that are not in constant use must be filled up, or otherwise impermeably closed. Great objections are always raised on the score of expense and possible failure of pipe supply when this measure is proposed, even by those who can easily afford it, and should know better ; so, until the supply and distribution of pipe water can be improved and put beyond reproach, it is probable that both anopheles and fever will coexist in Black Town and elsewhere. When the number and position of the unused wells is more accurately known, and such of them as can conveniently be closed have been closed, it will be possible to consider whether it will be worth while to send a tank of kerosine round and oil the surfaces of all the rest at regular intervals at the public cost.

An endeavour was made to ascertain the prevalence of chronic malaria in some of the outlying parts, as well as in the city itself, by examination of the spleens of as many persons as could be induced to submit to it. Of the 1,199 persons examined in representative localities eight adults and two children had enlarged spleens due to malaria = ·8 per cent. of the total.

In order to collect information with regard to certain points in connection with malaria a circular was distributed to some 200 medical practitioners in the city in January, with the request that they would make observations on the lines suggested during the succeeding twelve months, and communicate their results for tabulation. It is hoped that if a fair percentage are kind enough to comply some valuable facts will be obtained.

Through the kindness of medical officers in charge of hospitals films of blood taken from patients admitted as cases of malaria were prepared and sent for examination. As a rule only one specimen from each patient was obtained, and that not always a very good one, which possibly accounts in a large measure for the failure to find parasites in so high a percentage. In three of these cases another organism belonging to the sporozoa was found in the blood films, which raises the suspicion that a certain proportion of the cases of fever that are usually classed as malaria are in reality due, not to the malarial haematozoon, but to other species of sporozoa. This subject has, however, been discussed at greater length elsewhere.

Table of results of examination of Blood Films during November, December, January, February and March.

Source.	Total No. Examined.	Nothing found.	Crescents.	Intra corpuscular Tertian-parasites.	Other Sporozoa.
General Hospital	18	11	—	7	—
Native Infirmary	30	21	2	4	3
Royapettah Hospital	31	22	5	4	—
Elsewhere	8	7	1	—	—
Total	87	61	8	15	3

The conclusion is forced on us that a disease which has prevailed for centuries over extensive areas cannot be exterminated off hand without enormous expenditure, and measures that to the masses would seem arbitrary and uncalled for. In spite of vaccination small-pox dies hard. Stringent legislation and large annual grants during the past 16 years have resulted only in bringing it under control. Even supposing that the last word about malaria had been said, which is by no means certain, the most sanguine hygienist could scarcely hope to effect much in less than a decade. The lines on which the work of prophylaxis should proceed are already clearly and strongly indicated ; and, in following them, each year should see progressively effective work being carried on, the full benefits of which cannot, however, immediately manifest themselves.

Small-pox.—The total number of deaths registered in 1900 from small-pox was 46 against 34 of the previous year. The incidence on the vaccinated and unvaccinated is shown in the following table :—

	Attacks.	Deaths.	Fatality.
Unvaccinated	87	33	37·93
Said to be vaccinated but no marks	34	6	17·64
Vaccinated	37	7	18·91
Had previous attack of small-pox	1	—	—
Total	159	46	28·93

	Total deaths.	Under 10 years.	10–20.	Over 20.
Unvaccinated	33	20	6	7
Vaccinated	7	5	—	2

Cholera.—As was mentioned in the report for the previous year the city was comparatively free from cholera during the year 1899. Only 23 deaths were attributed to this cause, the last four months of the year being entirely free from the disease. During the year 1900, the year under report, the case was different. There were cases of cholera in the city all the year round with varying degrees of severity at different periods. In January, 3 attacks and 2 deaths were reported. Of these, one was a case removed from a vessel with passengers from Negapatam to Rangoon. The second and third cases were also purely imported cases, the disease appearing within a short time of their arrival in the city from Chithumbaram where cholera was said to be prevailing at the time. No cases occurred in February and March. In the month of April a death from cholera among the convicts of the Penitentiary was reported by the Surgeon in charge, no information however as to the source of infection was given. Four attacks and 4 deaths were reported in the month of May—3 out of the 4 cases being imported. June returned 5 attacks and 5 deaths. Of these one death was directly traceable to infection derived from a previous case—that of Omar Sahib, the cotton merchant from Madura, the victim being his son. Two cases were taken from s.s. *Ethiopia* and *Penticasta* with passengers from Negapatam to Rangoon. The fourth case occurred in the Penitentiary. The fifth case was that of a Eurasian young lady who came to the city two months previous to the attack for her education. This appears to have been a sporadic case originating in the city. So of the 13 cases that occurred till the end of June only 2 cases were among the permanent residents of the city. In July the disease steadily got worse, cases almost unconnected with one another rapidly springing up in different parts of the city—21 attacks and 16 deaths—a larger number than all the previous months of the year put together were reported. With the exception of 4 cases—2 from s.s. *Ethiopia*, one from Negapatam, and one from Sholapur, and one from a village in Chingleput district, all the remainder were cases that sprung up in the city. From these sporadic cases the disease rapidly spread in spite of all efforts to check it, due no doubt to the very favourable seasonal condition of the time, and was epidemic in the city in August, September, and October—302 attacks and 224 deaths, 300 attacks and 234 deaths, and 115 attacks and 94 deaths, occurring respectively in these 3 months. The disease gradually declined from the latter part of October—November returning but 24 attacks and 21 deaths, and December 48 attacks and 31 deaths.

These figures cannot by any means be taken as representing the full number of attacks and deaths within the city for the year 1900—for this can never be known accurately under the conditions now existing in the city. The figures merely show the number of cases that came within the notice of the Sanitary Department. It is more than probable that a large number of deaths registered under "Fever" and "other diseases," especially during the time of the epidemic, was due to this disease. Owing to the great dislike the mass of the population entertain towards precautionary measures, chiefly disinfection, this course was adopted. It is not possible for the Municipality to prevent it. Causes of deaths are not certified by qualified medical practitioners, nor is it possible at present, as the large majority of the population still look up to Barbers, Vydians, and Hakims, for treatment.

The present epidemic, in accordance with what was seen in previous years, commenced about July, steadily increased in severity in August, September, and October, and came down in November and December. That the seasonal condition of the time more than anything else is the influencing agent in the spread of the disease can no longer be doubted. Previous epidemics of cholera in the city have almost without exception occurred at this period of the year.

There was, however, one peculiarity with regard to the present outbreak of cholera in the city. It was the fact of the presence in the city of a large number of homeless, famine stricken, people from villages of various parts of the Presidency affected with scarcity. These poor men and women with their children, in the hope of bettering their condition, flocked in large numbers to the city. Early in July it was found that the shade of large trees in public roads and open plains in the city were made the homes of these people. They wandered about the city the whole day begging, and returned to their shelters in the evenings. There was yet another class who had not quite reached this level. They did some honest work all day and then occupied some pials of houses. That among these two classes the disease was particularly rife is seen from the fact that about a tenth of the total number of cases was among these people. Considering their small number to the population of the city it must be said that the disease made great havoc upon them. There is nothing surprising about this as it is only natural that a set of people whose vitality has been reduced by continued starvation fall but easy victims to

any epidemic disease. But what is interesting about these cases is not their actual increasing the number of deaths as it is of their contributing so largely to the spread of the disease. Instead of each case establishing one centre of infection it established several centres by actually wandering with the disease from place to place. As many of these cases were picked up in a collapsed state no information as to the places occupied before could be obtained, and no disinfection could consequently be done.

The total number of deaths from cholera was 632, giving a ratio 1·3 per 1,000 of the population. Since 1891 only once this number was exceeded, and that was 1898.

Infantile Mortality.—The infantile mortality, *i.e.*, the ratio of deaths under one year to every 1,000 births is generally considered to be a valuable indication of the state of health of a community, having due regard of course for the influence of other factors. Judged by this standard it is seen that Madras compares by no means unfavourably with the other two Presidency towns of recent years, even before the advent of plague. By their own confession the birth statistics of Bombay are admittedly unreliable, and the ratio for 1900, though correct as far as figures go, requires some explanation. The low rates in Calcutta during the years 1889–92 are probably due to the limits of the town having been suddenly extended, while it took some time for the registration system to work regularly in the new districts. Though absolute accuracy cannot be claimed for the Madras rate, yet the probable error is small and under two per cent. Although the ratio of deaths under one year per 1,000 births remained the same as last year, namely, 272 per 1,000, the ratio of deaths under one year, calculated on the total infantile population according to the 1891 census, rose from 363·8 to 411·5 per 1,000 concurrently with the rise in the general death-rate from 38·1 to 46·2.

Vaccination.—The total number of vaccinations performed within the City of Madras during the official year 1900-1901 was 32,571 against 24,959 in 1899-1900, showing an increase of 7,612 cases. The increase was due to the prevalence of small-pox in the city and to the Vaccination of the Natal and Mauritius Emigration coolies.

Out of 32,571 Vaccinations performed 19,312 were males and 13,259 females. Of the total, 26,696 were successful, 2,419 unsuccessful, and 3,456 unknown. The results of 3,456 cases were not ascertained as it was due to the release of the convicts of the Penitentiary undergoing short terms of imprisonment of from 3 to 5 days and to the rejection of the Emigration coolies who, after vaccination, were found physically unfit by the Medical Inspectors.

Under the revised bye-laws passed in February, 1898, 10,552 cases were brought to the Vaccine Depôts for inspection of the result of the operation out of a total of 28,376 cases vaccinated in the Municipal Vaccine Depôts. With the exception of the jail convicts (2,252) the result of 15,572 cases vaccinated were ascertained by the Vaccinators of the respective Divisions, and to minimize prosecutions under bye-law 5 the parents and guardians who failed to produce the vaccinated children for inspection were warned to take them to the Vaccine Depôts for the inspection of the Vaccinator. The result of 2,252 convicts vaccinated in His Majesty's Penitentiary were inspected by the Deputy Inspector of Vaccination during his weekly visits.

Of the total number vaccinated, 1,698 were Europeans, East Indians and Native Christians, 2,070 Muhamadans, 28,798 Hindus, and 5 other castes. Out of 32,571 cases vaccinated, 19,875 were primary vaccinations against 19,082 in the previous year, showing an increase of 793 cases, the increase being due to the vaccination of the Natal and Mauritius Emigration coolies and to the prevalence of small-pox in the city. The percentage of success in primary vaccination was 98·61, showing a decrease of 1 per cent. below the year 1899-1900, and the cause of decrease is attributed to the different kinds of lymph employed in vaccination, viz., calf to arm, glycerinated lymph, and lanoline vaccine paste. The number of re-vaccinations done among the adults was 12,696 against 5,877 in the preceding year, showing an increase of 6,819 cases. The percentage of success in re-vaccination was 78·18, showing an increase of 1·82 per cent. over 1899-1900.

During the year 13,687 infants under one year of age were vaccinated, including those which were done in the Emigration Depôts, against 13,530 in the preceding year, showing an increase of 157 cases. The percentage of success was 99·58 against 99·73 in 1899-1900, showing a small decrease of ·15 per cent. The decrease is due to the low percentage of success obtained in the Emigration Depôts, viz., that out of 78 cases vaccinated under one year from lanoline vaccine paste 68 were reported as successful.

Plague Measures.—During the year plague was indigenous at Vaniyambadi, and there were ten imported cases, against four last year, although the indigenous boundary was further away. Large numbers of Muhamadans left Vaniyambadi and came to Madras to avoid being troubled by the plague precautions there. Enquiry showed that the disease was not prevailing among this community, so their arrival did not give rise to any anxiety. It is not possible to give a more favourable forecast of what the future may bring to Madras than could be given in the two preceding years. No new facts concerning the march of plague epidemics have been recorded, and reason consequently forbids reliance on the comforting though unsupported belief in the antagonistic effect of the climate of Madras on the bacillus of plague.

Sanitary Defects and Sanitary Progress.—The Mylapore drainage system has continued to afford satisfaction. There was but little heavy rain throughout the year, so no complaints were received of flooded courtyards or backing up of sewage. On the other hand complaints from the neighbourhood of St. Thomé High Road were both frequent and forcible. They all referred to unbearable smells at night, the direction of which could not be specified. Every attempt to locate the cause failed, and no assistance could be obtained from the complainants, who were all informed of the address of the Sanitary Inspector, and urged to send and fetch him at whatever hour the smell might be perceived, so that he might have a chance of tracing it to its source. No messages, however, were ever sent to him. Finally, after a number of the ventilating pipes had been raised, more as a sop than in the conviction that they were at fault, the complaints, and, presumably, the smell also, ceased.

A point that must not be lost sight of in the extensions of this system to other parts of Madras is that ventilating tubes, more especially those of small diameter, should lead directly without angles or curves from the point to be ventilated to the open air. In Mylapore it is not unusual to find two right angles in such tubes, and even as many as five right angles in a 1½-inch tube are seen in more than one place. This means, of course, that many of the tubes are utterly useless as ventilators unless there is enough pressure of gas inside the sewer to overcome the friction. When the pressure in the sewer is the same as that of the air, the usual condition, there can be little or no interchange of gases through a narrow tube with four or five right-angled bends.

Wherever this sewerage system is laid down in Madras it will be necessary to keep two gangs of coolies, one to flush and clean out the house connections, and the other to attend to the deposits in the manholes and pipes. Neither house connections nor pipes can be left to look after themselves.

The drainage scheme is slowly progressing. The first two miles of the cast-iron main were laid in the 1st Division, but the work has been stopped for some months owing to a controversy with the Madras Railway. The wells of the Ice House Road pumping station have been sunk and a pipe laid the whole way from there to Mount Road with some side connections. It will be a great advance when the sewage of Royapettah can be carried away down this drain, and its apology for a sewage farm can cease to exist. As the work of pipe laying proceeds the structure of the ground excavated will be noted, so that eventually it will be possible to form a better idea of the surface strata in different parts of the town.

Attention must be drawn to the fact that the present drainage loan does not provide for any alteration in the existing drains of Black Town. This system of side drains, from which apparently so much was expected at its inception some 15 years back, must, after due experience, now be condemned without qualification. No advantages over closed drains with trapped house connections, wherever the latter are applicable, can be claimed for these open side drains, often without proper gradients, whereas space will not admit of even an attempt to enumerate their disadvantages.

Open cemented side drains are only two steps in evolution above the primitive gutter in the earth at the roadside locally known as a "ditch drain." Intermediately in the series is placed the square, leaky, open, brick drain. Together with the defective system of side drains there exists a deficiency in the carrying capacity of at least one of the three large sewers of Black Town, namely, sewer No. 1, which runs the whole length of Popham's Broadway. Whether this sewer was originally made too small, or whether the volume of sewage that now finds its way into it has been largely augmented of recent years by reason of additions to the number of public and private water taps, the fact remains that it is now unable to carry away the sewage sufficiently fast. It will shortly therefore have to be relaid on a larger scale.

The southern outfall of the old main drain is the cause of annual correspondence with the military authorities in Fort St. George. Some eight years ago it was decided to prevent any sewage finding its way into this enormous old drain at any point at ordinary times, and to reserve it for carrying off the overflow and storm water during the rains. It is now found, however, that the main drain has sewage flowing into it at all times, partly from existing openings having been overlooked at the time of the diversion of the sewage mentioned above, partly from surreptitious connections having been subsequently made by adjacent householders, partly from the blockage of the silt traps of the side drains during the night and early morning with leaves and straw, when the side coolies are not on duty to attend to them, and partly from the insufficiency of sewer No. 1. Hardly any of the openings into the main drain are trapped, and the smell given off at various points from it is most offensive. The drain is bound to exist as a storm water channel unless other provisions can be made, but in its present condition it is a most unhealthy adjunct to the sewers, and the percolation from it is liable to contaminate wells in its immediate neighbourhood. Steps are now being taken to remove the silt which has accumulated in it by a rearrangement of the departmental coolies without having recourse to a contract and large expenditure as on previous occasions years ago. Some idea may be formed of the time this is likely to take when it is known that 100 feet of this drain contains from 1,600 to 2,400 cubic feet of solid mud.

A certain amount of water pipe cleaning has been done in the course of the year; besides this nothing particular has been done. Owing to a somewhat severe outbreak of cholera in villages near the Red Hills Tank the question of acquiring a part at least of the catchment area was again freely discussed. A special staff, consisting of a sanitary inspector and peons and coolies, was appointed to aid the permanent conservator and his men in their work of keeping watch over infected villages and preventing fishing and washing of cattle in the tank, while further measures were taken by the Collector of Chingleput. The channel to Kilpauk also claimed attention. It may be here pointed out that, since the scheme for the improvement of the water supply is a comprehensive one, and will cost many lakhs, it will not be possible to carry it to a conclusion for many years. It is only reasonable, therefore, that the most important part of the scheme, that is, the part which will have the greatest influence in improving the quality of the water, and reference to the Chemical Examiner's analyses and former reports will show how necessary that improvement is, should be undertaken first of all. It is self-evident that the nearer to the taps contamination of a water supply occurs the less chance exists of self purification and the greater the likelihood of evil effects following upon the use of the water. Therefore, instead of spending money in acquiring a catchment basin twelve miles away, it would be a sounder policy to commence the work at the nearest point, namely Kilpauk, and erect some species of filter. When funds allow, extensions can be made further afield by covering in the channel, or laying a masonry aqueduct, and, finally, completing the scheme by acquiring the catchment area. The only permissible deviation from this order of procedure would be to temporarily fence the channel with barbed wire or otherwise if there appears to be no possibility of obtaining funds for the larger and more radical work of filtration for many years.

LIBRARY OF THE BOMBAY BRANCH OF THE ROYAL ASIATIC SOCIETY

ABSTRACT OF THE REPORT OF THE ACTING MUNICIPAL COMMISSIONER OF BOMBAY CITY FOR 1900-1901.

(*W. D. Sheppard, Esq.*)

Public Works.

Special Drainage.—The Special Drainage Department was placed under the Executive Engineer as a branch of his department. The works executed or under execution in the Special Drainage Branch during the year included the ovoiding and constructing of masonry side drains and the construction of storm-water drains in various parts of the city, the improvement of roadside drains and water courses in and about Dadar Road, the erection of machinery for various Sectional Sewerage Works, the construction of the Mazagon Sectional Sewerage Works, the Fergusson Road and Chinchpokly Sewerage Works, and the Parel Sectional Sewerage Works. During the year the Corporation, after obtaining the opinion of the late eminent sanitary engineer, Mr. Santo Crimp, sanctioned the construction of certain works, costing in the aggregate about £90,000 for the drainage of the lower parts of the city. The scheme involves the cutting off of all tidal communication from Mahim Bay at a certain point, and Government are about to undertake legislation extinguishing all tidal rights and rights of navigation at that point. When the Act is passed it will be possible to proceed with the works.

Pumping Station at Love Grove, Worlee.—The engines and pumps worked satisfactorily during the year. There was a stoppage of the pumps for about seven hours on the early morning of the 26th July, 1900. This was immediately remedied. The efficiency of the pumps as tested by monthly observations showed an average of 88·58 per cent.

House Connections.—The street portions of house drainage connections carried out by the contractors numbered 6,002 at a cost of about £9,000.

Water Works.—*Tansa Lake.*—The rainfall for 1900 was 104·60 inches against 40·07 inches for 1899. Owing to the early cessation of the rain the lake fell to 391·6 T. H. D., the lowest level on record. The total quantity of water received in the lake was 41,888 million gallons, or 52 per cent. of the rainfall on the catchment area of 52·5 square miles. A large number of old trees, which had been left in the lake when it was constructed, were cut down and removed at the end of the hot weather when the level of the lake was at its lowest. On the night of the 18th February, 1901, a portion of the Tansa duct gave way. The repairs were executed by the evening of the 28th, and water was turned on again in the duct on the 1st March. One burst on the 48-inch pipe necessitated the water being shut off for nearly 36 hours.

Vehar Lake.—The rainfall for 1900 was 72·96 inches against 35·26 inches for 1899. The total quantity of rain which fell in the whole drainage area of 3,900 acres was about 6,450 million gallons, of which about 4,650 million gallons reached the lake or 72 per cent. of the total rainfall. The margin of the lake was thoroughly cleared of weeds which were rooted out as the water receded.

Tulsi Lake.—The rainfall for 1900 was 93·02 inches against 43·80 inches for 1899. The total quantity of rainfall on the whole drainage area of 1,700 acres was about 3,602 million gallons, of which about 2,778 million gallons reached the lake, or about 77 per cent. of the total rainfall.

Supply and Distribution, &c.—There were 135 bursts in several mains. 379 new connections were made and 189 connections were cut off for various reasons. The total number of connections is 20,394.

Public Health.—The state of the public health during the year was not satisfactory, the total mortality, exclusive of still-born, being 79,350. This mortality is the highest ever recorded for the city.

There were 13,285 deaths from plague, against 15,796 during the previous year. Plague measures have been carried out as before by a separate branch of administration.

On an average 6,862 men and women and 1,188 scavenging and drain carts, and 204 night-soil and cesspool carts were at work each day. 348,152 tons of garbage, equal to 953·84 tons a day were collected, removed and disposed of against 344,268·5 tons of garbage in the preceding year. 172,459·83 tons of night-soil and cesspool matter, equal to 473·04 tons a day were collected and removed against 170,506·11 in the previous year. 202 miles of covered drains were opened and cleaned against 167·1 miles in 1899.

ABSTRACT OF THE REPORT OF THE HEALTH OFFICER OF BOMBAY CITY FOR 1900.

(*J. A. Turner, Esq., M.B., D.P.H.*)

Population.—The population of Bombay City, estimated by the Census of 1891, was 821,764, and it is on this population that the statistics for 1900 are based.

Births.—The number of births registered was 12,688, giving a birth-rate of 15·43 per 1,000 of population. Owing to the faulty system of birth registration these figures are unreliable. Owing also to the migratory habits of a certain class of the population a proper register of births has hitherto not been available.

The abnormally low birth-rate can be accounted for in many ways :—

1. The proportion of males to females 170·60 to 100.
2. The mother often leaves the city before the child is born, and this birth is not registered when she returns.
3. The occupation of the mother entailing hard manual labour under very indifferent conditions must have a very deleterious effect on the birth-rate.
4. Famine and plague have direct influence on the marriage-rate, and consequently on birth-rate.

The number of the births registered was, however, 2,064 more than last year. Of the total number of births 6,552 were males and 6,136 females ; 2,062 still-born births were also registered during the year under report. Birth-rate amongst Parsees and Europeans is little higher than in the previous year.

Deaths.—The number of deaths in the City of Bombay during 1900, exclusive of still-born, was 79,350, giving an annual death-rate of 96·56 per 1,000 of the population. This mortality is the highest ever recorded in this city.

The death-rate from all causes during the past 10 years was.:—

Years.	Death-rate.	Years.	Death-rate.
1890	25·35	1895	30·52
1891	29·01	1896	40·71
1892	32·26	1897	58·28
1893	28·16	1898	63·23
1894	53·25	1899	68·07

Mortality from Zymotic Diseases.—The principal zymotic diseases, under the heading of which deaths are returned in Bombay, are Plague, Cholera, Small-pox, Measles, Ague, Enteric Fever, Puerperal Fever, Relapsing Fever, Remittent Fever and Malaria. The number of deaths from zymotic diseases was 34,998, giving a zymotic death-rate of 42·58 per 1,000 of the population.

TABLE SHOWING THE NUMBER OF DEATHS AND THE DEATH-RATE FROM DIFFERENT CAUSES IN 1900.

Cause of Death.	No. of Deaths.	Death-rate per 1,000 of Population.
Small-pox	3,018	3·67
Measles	1,500	1·82
Fevers	7,928	9·64
Cholera	4,273	5·19
Plague	13,285	16·16
Phthisis	8,199	9·97
Diseases of the Nervous System	4,328	5·26
Do. Respiratory System	12,522	15·23
Diarrhœa	5,850	7·11
Dysentery	2,826	3·45
Accidents	1,072	1·30
All other Causes except Still-born	14,549	17·70
Total	79,350	96·56

Plague.—During the year the control of all plague measures was under Government. The Municipal Commissioner with his personal assistant and officers of the army, were appointed to carry out the measures for the control of plague. Under these officers were appointed a number of medical men and subordinate staff to carry out the only measures enforced; namely, disinfection by washing the floors and walls of infected houses with a solution of perchloride of mercury 1 in 1,000 parts. Evacuation of infected houses, and removal to hospital was not enforced. The returns available show that there were 17,913 attacks and 13,285 deaths from the plague. In 1899 there were 19,051 attacks and 15,796 deaths.

Total mortality.—45,429 males and 33,921 females died during the year; excluding those under five years, the highest number of deaths amongst males occurred in the age-period between 25 and 29 years, 4,789 deaths having been registered; and amongst females, 4,709 in the age-period of 60 and over.

Amongst persons born in Bombay 18,524 deaths were registered during the year and amongst those born outside of Bombay 57,977.

It is noticeable that the low caste Hindus, excepting negro Africans, Buddhists and Lingaets who form very small communities, show the highest mortality, *viz.*, 214·57 per 1,000 of population. The Jain community, which includes Banias, also suffered much, their death-rate being 95·73. Mussulman give a death-rate of 102·57, and the general mass of the Hindus give a death-rate of 97·12, the death-rate amongst Parsis was 37·63. European death-rate being little higher than in the previous year.

Small-pox.—This disease was very prevalent during the early part of 1900, 3,729 attacks and 3,018 deaths occurring. This gives an increase of 2,578 deaths over last year, and 2,714 more than the average of previous five years. As in other diseases Hindus of other caste suffered the most, Hindus low caste and Mussulmans being the next. There were 16 deaths amongst Europeans. The disease was practically confined to children under one year of age.

Cholera.—There was a serious epidemic of cholera during the year, 4,815 attacks and 4,273 deaths being registered, against 111 deaths in 1899. The

disease began in January (1–1–1900) and continued until December (28–12–1900). Strict precautions were taken to prevent the disease spreading. The highest number of deaths from this disease were registered in the month of August. Amongst sections Byculla had the greater number of deaths from cholera. Of the total number of deaths 2,948 occurred amongst Hindus of other castes and 628 amongst Hindus low caste. A total of 332 deaths occurred amongst persons who had resided in Bombay for three months and under and 445 deaths occurred amongst persons who resided in Bombay for six months. The great number of deaths occurred in persons born outside of Bombay.

Fevers.—A total of 7,928 deaths was registered from fevers. Remittent fever claims the highest number, viz., 7,278, being 2,517 more than the last year and 1,913 more than the average of the previous five years. To simple continued fever 45 deaths were ascribed, being 99 less than the last year and 611 less than the average. To enteric fever 60 deaths were put down, being 16 more than the last year and 23 more than the average of the last five years. To ague 545 deaths were ascribed, being 431 more than the last year and 342 more than the average. Out of the large number of deaths returned as due to remittent fever, many may have been due to relapsing fever and plague, as it is very difficult to diagnose the disease without strict examination being held in each case. The fever mortality rose and fell with the mortality from plague. It rose from January to March, when 1,166 deaths were registered. The highest number of plague deaths registered in the month of March was 3,125. From the month of April fevers gradually decreased till the end of the year. Amongst the Hindus of low-caste there was a considerable increase, the rate being 22·18 as against 14·61 in the previous year. There was also an increase amongst the Hindu community and Mussulmans. Parsees showed a slight increase and the Europeans a slight decline. Dongree, Byculla, Parel, and Mahim sections give the highest incidence of fever mortality.

Measles.—From measles 1,500 deaths were registered from this disease, being 368 less than in the last year, and 847 more than the average of the preceding five years. Great number of deaths occurred amongst Hindus of other caste. The Hindus low-caste give the highest death-rate. The infant mortality, due to measles, was high and the age-period under two years was the most fatal. The female death-rate from this disease was little higher than that of males.

Phthisis.—From phthisis 8,199 deaths were reported, being 2,170 more than in the previous year. It is difficult to say how far these figures are correct as a very small percentage of the deaths were certified by medical practitioners. Other diseases of the respiratory system amount to 12,522 deaths under the heading of bronchitis, pneumonia, pleurisy, &c.

General.—From diseases of the digestive system 10,504 deaths were registered, being 4,945 more than in the previous year and 6,419 more than the average. Diarrhœa and dysentery show a very marked increase both as against last year and on the average. To diseases of the nervous system 4,328 deaths were registered, being 1,316 more than the last year and 2,919 more than the average. 12,522 deaths were ascribed to diseases of the respiratory system, being 3,872 more than in the last year and 5,557 more than the average. To diseases of the circulatory system 348 deaths were registered, being five more than the last year and 89 more than the average.

APPENDIX

No. 1.

MEMORANDUM by the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER with the GOVERNMENT of INDIA for 1900.

The Report is shorter than its predecessor. Whilst the latter covered 244 pages, the present is limited to 139. The number of returns accompanying the report has likewise undergone reduction. It is a pity that it should have been found necessary to omit Tables XIV. and XXXIX., giving "Statistics of Regiments." By means of these two tables the health statistics of, and the stations occupied by, each corps, European and Native, during the year could be ascertained at a glance. They took up a good deal of space, 33 pages between them; and this doubtless suggested their suppression.

2. Like the preceding year, that under report was one of abnormally high temperature; April and October were the only two months in which temperatures about normal were recorded. The excess of heat was greatest in February and March. The rainfall, for India as a whole, was approximately normal. But such a general statement regarding rainfall has to be taken only for what it is worth. Although the rainfall recorded for India, as a whole, might be approximately normal, inquiry would show that its distribution was irregular, one part suffering from excess and another from defect; and, moreover, that the fall, though locally normal in quantity, might be unseasonable. That the climatic conditions of the year exercised an important influence on the course of the destructive epidemics of cholera, small-pox, and fever may be assumed; but, in spite of increasing knowledge of the causation of disease in some special directions, much still remains obscure regarding the relationship which is believed to exist between epidemics and meteorological conditions.

3. The average annual strength of the European Army of India decreased from 67,697 in the previous year, to 60,553 in the year under review. The returns show that, whilst the rate of admissions into hospital and the constantly sick rate were slightly below those for the preceding year, the death and invaliding rates were considerably higher. The ratio of deaths, per thousand of the average strength, which had been 12·75 in 1899, rose to 14·62 in the year under report; whilst the ratio of invaliding which had been 31·64, rose to 33·46. The two chief causes of admissions were, as usual, ague and venereal disease; the former being credited with 27 and the latter with 26 per cent. of the total number from all causes. These figures show that ague was much more prevalent, and venereal disease considerably less prevalent, than in the preceding year. Between them, they were accountable for 53·05 per cent. of all the admissions, as compared with 47·76 in 1899. Whilst the admissions due to ague increased from 235·2 to 308·5 per thousand of strength, those due to venereal disease fell from 313·4 to 298·1. The two chief causes of death were, again, enteric fever and hepatic abscess; whilst the former accounted for 33 per cent. of all the deaths, the latter accounted for 11 per cent. These figures show a reduction in the percentage of deaths due to enteric fever from 40 in the previous year to 33 in the year under review; and an increase from 10 to 11 in the percentage of deaths due to hepatic abscess. With a percentage of total deaths in the Army of 9·9, cholera was little behind hepatic abscess as a cause of mortality. Between them, these three diseases accounted for 53·3 per cent. of the total mortality for the year. As a cause of invaliding, secondary syphilis, again, took the foremost place, followed, but at long intervals, by debility and intermittent fever. Together, these three diseases caused 735 out of a total of 2,026 invalidings from all causes.

4. Of the four Commands, Madras and Bombay were the most unhealthy, the former recording the highest constantly sick and admission rates, and the latter the highest death-rate. The Punjab, which in the previous year recorded the highest death-rate now records the lowest. As usual, the incidence of enteric fever is an important factor in determining the relative mortality in the several commands and stations. To the death-rate of the Bombay Command enteric fever contributed 6·71 of its total of 17·08 from all causes; and to that of Madras 4·71 of 16·53. The Punjab and Bengal Commands, with the lowest death-rates from all causes, had also the lowest death-rates from enteric fever; the former recording from this disease a death-rate of 4·35 out of its total from all causes of 12·62, and the latter of 3·64 out of 13·40. Comparing the geographical groups it is shown that the decennial admission rate from cholera was highest in the Gangetic Plain, and the decennial admission rate from enteric fever highest in the hills. The Indus Valley recorded the highest admission rates from ague and also from pneumonia; whilst the Orissa group recorded, as hitherto, the highest from dysentery. No doubt, a general indication of the healthiness or unhealthiness of the several Commands, Geographical Groups, and Stations, may be gathered from the records of their admission and death-rates during a series of years; but the influence which special conditions affecting the troops may have on these records cannot be left out of count. The ages of the men, their length of service in India, their previous exposure on field service, or in camp during epidemics, might all have effects on the statistics of sickness and mortality furnished by the several geographical groups or stations. If estimated solely by the returns of sickness and mortality amongst the troops forming its garrison, without taking into account such special conditions as those mentioned, a station might appear to be healthy during certain years and unhealthy during others, whilst its sanitary state, so far as could be determined by investigation, continued the same or had improved.

5. The returns of the previous year recorded a single death from each of the three diseases, *cholera*, *influenza*, and *small-pox*. During the year under report there were 88 deaths from cholera, none from influenza, and three from small-pox. In a year when cholera prevailed with exceptional severity amongst the people of India, it was not to be expected that the troops stationed in their midst would escape. In British India alone, nearly 800,000 deaths from cholera were registered; and it is certain that there were many more which escaped registration. During the two preceding years, 1898 and 1899, the disease was in remarkable abeyance in India, and the mortality due to it the lowest on record. Accompanying this comparative freedom of the general population from cholera during those two years, the European Army enjoyed a corresponding immunity, only 14 deaths having been caused by it in the former of the two, and only one in the latter. Its recrudescence in wide-spread epidemic form amongst the general population in the year under review was accompanied by its increased prevalence amongst the troops, European and Native. That the death-rate from cholera in the European Army did not exceed 1·45, per 1,000 of strength, whilst amongst the general population it rose to 3·7 may be taken to indicate the better sanitary conditions under which the former, as compared with the latter, met the epidemic.

6. *Ague* was more prevalent and fatal in the European Army than it had been in the previous year. As with cholera and small-pox, increased mortality from ague in the European Army accompanied increased mortality from ague in the general population. The deaths ascribed to this cause amongst the latter increased by nearly 19 per cent. Excess of rainfall and the floods therefrom resulting are mostly assigned as the causes of this increase. The Report deals at considerable length with the recent researches into the causation and distribution of malarial fevers. The part which mosquitos play in connection with these fevers is being closely studied by numerous investigators in various parts of the world. It is confidently predicted by the more sanguine that the application of the knowledge now being acquired to the prevention of these diseases will lead, if not to their entire disappearance, at least to a marked decrease in their prevalence. The methods hitherto found to be the most effectual in preventing and curing malarial fevers do not appear likely to lose any of their importance as a consequence of recent discoveries. On the contrary, it seems probable that drainage and the use of quinine may in future have more value than ever assigned to them in the combat with these diseases. The mode of action of drainage and quinine on malarial fevers has hitherto been imperfectly understood. The tendency of the researches in progress seems to be towards an elucidation of their mode of action, and to showing that their application rests on a scientific basis.

7. The death-rate from *enteric fever*, which had been 10·17 per 1,000 of strength in 1898, decreased to 5·14 in 1899, and now in the year under report to 4·77. Lessened influx of drafts from England and less field service, the causes to which the diminution of the disease during the preceding year was ascribed, continued also throughout the year under report. No such connection as that shown to exist between the rise and fall in the prevalence and mortality from cholera, small-pox, and malarial fevers among the general population, and their rise and fall amongst the European troops, can be traced in the case of enteric fever. Reliable statistics of the prevalence of the disease amongst the natives of India are mostly limited to those furnished by the Native Army and jails. Whilst the recorded deaths from enteric fever numbered 289 out of a strength of 60,553 European soldiers, there were only 18 in the Native Army with rather more than double the strength, and only 17 out of an average strength of 121,511 prisoners. As in previous reports, a *résumé* is given of the latest additions to the literature of enteric fever. The same conflict of opinion regarding the question of the media by means of which infection is communicated, prevails amongst those who write on the subject; a diminishing number claiming that the disease is "solely water-borne," some blaming flies and others dust for diffusing infection. Amidst much that is still undecided and obscure, the records of sickness and mortality support the conclusion that young soldiers of the ages of from 20 to 25 years, and those in the first year of their residence in India are the most liable to contract and die from enteric fever.

8. The prevalence of *venereal disease* has continued uninterruptedly to decrease since 1895, during which year the admission-rate due to it had attained its maximum of 522·3, per 1,000 of strength. The admission-rate for the year under report was 298·1. Although only 14 deaths were attributed to venereal disease during the year, the sickness and invaliding caused by it were greater than those caused by any other disease. As in the case of enteric fever, part of the decrease in the prevalence of venereal disease is attributed to there having been fewer drafts of young soldiers. So far, the measures adopted during recent years with the object of lessening the disastrous effects of this scourge have been productive of marked benefit; but the returns show that there is still ample room for further reduction of the numbers rendered inefficient by it.

9 The average strength of the *Native Army* was 123,463, or less than in the preceding year by 5,066. There was a considerable increase in the rate of admissions into hospital, and a very great increase in the death-rate. To greater prevalence of ague the increase of the admission-rate was mainly due; whilst cholera was chiefly responsible for the marked rise in the death-rate. This last, which had been only 10·70, per 1,000 of strength, in the preceding year, rose to 14·04 in the year under report. Pneumonia caused nearly 24 per cent. of the total deaths from all causes, and cholera over 22 per cent. Of the four Commands, Bombay was much the most unhealthy, returning a death-rate of 18·71, per 1,000 of strength, against the next highest of 14·72 in the Punjab. This high rate of mortality in the Native Army in the Bombay Command was synchronous with the prevalence of excessive sickness and mortality amongst the general population of the Bombay Presidency; the death-rate for which latter was 70·07, the highest on record.

10. Whilst *influenza* was less prevalent than in any year since the disease invaded India in 1890, *cholera* was unusually prevalent and fatal. The most important outbreak of cholera, that which occurred at Kohat, was traced, it was believed, to the use by the troops affected, of polluted drinking water. An inquiry into the causes of the outbreak by the medical officers on the spot appears to have led them to this conclusion. But the evidence in its support is not altogether complete. "It is not known how the irrigation water became infected, but the disease was at the time spreading

epidemically in the Punjab, and the first reported death in Kohat city was reported on the 5th July," the day before the regiment which suffered most marched into the place. "The men of the 6th Punjaub Infantry and other regiments are also supposed to have drunk the polluted irrigation water, because it was so much cooler than the pipe water." The morbific agent of cholera does not appear to have been detected in the water, although "the ready detection of spirilla and allied forms was considered sufficiently confirmative of the suspicion attaching to the stream."

11. *Malarial fevers* were more prevalent in the Native Army than during the previous year, as they likewise were amongst the general population: but the mortality due to them did not widely differ in the two years. The combined death-rate from intermittent and remittent fevers amounted to 1·85 per 1,000 of strength, in 1899, and to 2·27 in the year under review. There was, however, a marked increase in the number of cases attributed to *enteric fever*. In the whole Native Army, 54 cases with 18 deaths were returned, as against 18 cases with three deaths in the preceding year. The increase of enteric fever in the Native Army represented by these figures, during a year when there was a considerable decrease in its prevalence and fatality in the European Army, is not a little remarkable. It appears that whilst 16 regiments were contributors to the total number of 54 cases in the Native Army, one regiment, the 42nd Gurkhas, had no fewer than 29 admissions from this disease. In last year's Report we find the following remark regarding the prevalence of enteric fever in the Native Army :—"It may be worth mentioning that year by year one medical officer's diagnosis contributes a considerable proportion of the cases registered in the Native Army." The remark applies to one, although perhaps not to the same, medical officer during the year under report.

12. Along with increased prevalence of *small-pox* amongst the general population, the admission and death-rates from this disease in the Native Army showed a corresponding increase. The admissions numbered 78 and the deaths four. There were 56 cases of *plague* with 29 deaths. "The comparative immunity of the sepoys as compared with the populations surrounding them is ascribed to the large number of men inoculated, many of them twice, and to the immediate segregation of patients and evacution of buildings whenever cases did occur."

13. *Tubercle of the lungs* shows some increase in prevalence and fatality in the Native Army. Gurkhas are the chief sufferers from this disease; the five highest numbers of cases having all been in Gurkha regiments. In one of those regiments the Medical Officer attributes the increase of pulmonary phthisis "to the overcrowding, associated with small cubic and superficial space per man in the barracks." The Sanitary Commissioner remarks that if the prevalence of the disease among the Gurkha soldiers is not due to any special racial liability, and of this nothing is said by the medical officers, but is the result of defective sanitation, "it is high time that something was done to prevent waste of life among these valuable soldiers."

14. Although the mortality due to it was somewhat below that of the previous year, *pneumonia* was, as usual, the most fatal disease in the Native Army. It is probable that the slight decrease in the prevalence of the disease may have been due to there having been less influenza, of which disease it is a not infrequent concomitant or sequel.

15. The ratio of admissions from *venereal disease* increased from 34·1 per mille of strength in the previous year to 42·5 in the year under report. There were nine deaths and 129 invalidings directly due to it. The disease is thus seen to be by no means an unimportant cause of inefficiency in the Native Army, although its injurious effects seem inconsiderable when compared with those produced by it in the European Army. In the parts of the country which suffered most from famine, an unusual number of destitute women resorted, it is said, to prostitution; and to this cause the increase in the prevalence of venereal disease in some regiments is attributed by the medical officers.

16. The average strength of the *Jail* population of India closely approximated to that of the Native Army. The ratios of sickness and mortality amongst the prisoners were, however, far higher than those which prevailed amongst the native soldiers. Whilst among the latter the admission rate, per thousand of strength, was 784·6, amongst prisoners it was 976·6. Their death-rates differed yet more widely, the Native Army recording a death-rate of 14·04 against one of 34·2 by the jails. In jails, bowel-complaints were, as usual, the diseases most destructive to life. Between them, *diarrhœa* and *dysentery* caused 28 per cent. of the total jail mortality; in the Native Army the same diseases accounted only for 6·6 of the total mortality. It was only to be expected that the prisoners would suffer more from *tubercle of the lungs* and *pneumonia* than the Native troops. Whilst the former record a death-rate from these two diseases combined of 8·17, the latter record a death-rate from them of only 4·10. In other words, the troops, who pass more of their time than the prisoners in the open air, had about half the mortality from lung diseases recorded by the latter. From *cholera* the death-rate was high, both in the Native Army and in the jails, but considerably higher in the former than in the latter, a result perhaps due to the facilities for isolating prisoners at a time when the general population was suffering from the disease. The ratio of mortality from *enteric fever* was almost the same amongst prisoners and native soldiers, having been ·14 per thousand of strength for prisoners and ·15 for native soldiers. *Cerebrospinal fever*, hitherto an inconsiderable factor in the production of sickness and mortality in Indian jails, caused no fewer than 99 admissions with 79 deaths during the year under report. As observed by the Sanitary Commissioner with the Government of India, in his concluding remarks on the jails :—"The heads of jail mortality requiring special attention are bowel complaints, tubercle of the lungs, and respiratory diseases."

17. The remaining sections of the Report deal with the statistics and chief diseases of the general population, vaccination, and sanitary works; but as these subjects have been noticed in our Memoranda on the several Provincial Sanitary Reports they need not be again referred to here.

18. *Summary.*—The Report has been greatly reduced in length, and some of the tables of statistics which formerly accompanied it have been omitted. Amongst the latter, Tables XIV. and XXXIX. gave much useful information regarding the European and Native Armies. The meteorological features of the year did not widely diverge from normal, except that temperatures were higher than

usual in all of the months except two. Measured by the death and invaliding rates, the health of the European Army was not so good as in the previous year. The chief causes of admissions into hospital continued, as heretofore, to be ague and venereal disease; and the chief causes of death, enteric fever and abscess of the liver. The Madras and Bombay Commands were the most unhealthy; whilst the Punjab Command, which in the previous year recorded the highest death-rate, returned the lowest for the year under review. Cholera, which prevailed in severe epidemic form amongst the general population, caused considerable mortality in the European and heavy mortality in the Native Army. Ague was more prevalent than in the preceding year; whilst enteric fever was decidedly less prevalent and fatal—a result due in main part, it is believed, to lessened influx of drafts of young soldiers from Europe. Accompanying this decrease of the prevalence of the disease in the European Army, there was a marked increase in the number of the admissions and deaths attributed to it in the Native Army. A single regiment contributed more cases than all the rest of the Native Army together. Venereal disease shows a further decline, but still accounts for an admission rate of 298·1, amongst the European troops. In the Native Army there has been not only no decrease, but a considerable increase; the admission rate does not, however, exceed 42·5 per thousand of strength. Accompanying unusual sickness and mortality amongst the general population there was a marked increase in the admission and death-rates in the Native Army. A violent and fatal outbreak of cholera took place among the native troops at Kohat. Lung diseases are still the cause of much sickness and mortality in the Native Army, and especially among the Gurkha soldiers, suggesting the need for improving the ventilation of their quarters. Of the Jails of India the Sanitary Commissioner observes:—"The heads of jail mortality requiring special attention are bowel complaints, tubercle of the lungs, and respiratory diseases."

3rd June, 1902.

No. 2.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Bengal for 1900.

The Report, with the Appendices, is of less than half the length of its predecessors. Yet, according to the estimate of its value expressed in the Government review, "its utility is unimpaired." In the Government review itself, however, comment is made on the meagreness of the account given of *plague*. Endeavour on the part of the Sanitary Commissioner to throw "light on the origin of the disease, the causes which foster or retard its spread, or the success or failure of the measures adopted to check it" would probably have been found to be fruitless without exceeding the limits prescribed for the length of the Report. A similar comment might have been applied to the account given of the most destructive epidemic of cholera which has visited Bengal since the introduction of registration of vital statistics. Brevity is a commendable feature of the Report, but it is not without its drawbacks.

2. The year was an unhealthy one. The rainfall, which the Sanitary Commissioner considers to have an important influence on the health of the people, was, on the whole, considerably in defect, and also very irregularly distributed. It was generally scanty in the earlier months of the year, the monsoon was late in commencing, and the last two months were almost rainless over the greater part of the Province. These conditions are considered to have been not only unfavourable to the agricultural outturn, but to have been prejudicial to the public health. The mortality from all of the chief diseases exceeded that of the previous year.

3. Whilst the *death-rate* rose from 31·21 in the previous year to 36·63 in the year under review, the *birth-rate* fell from 42·96 to 38·68. The increase in the former was "chiefly due to the greater unhealthiness of the year under report as evidenced in the severe and widespread prevalence of fever and cholera throughout the Province." The high price of food grains during the greater part of the year was also, doubtless, a contributory cause to decreased fecundity and increased mortality. It is satisfactory to learn from the 7th paragraph of the Report that the measures which have proved so successful in improving the registration of vital statistics during recent years are being stringently enforced. The verification by vaccination officers of the entries of births and deaths shows that a considerable number of both still escape registration. In Bengal, as in other provinces of India, the difficulty is, and for years to come will doubtless continue to be, to secure a reliable record of the causes of death. Including, as it does, in its population a large number of qualified medical men, European and Native, it may be assumed that Calcutta furnishes a more accurate return of the causes of death than the rest of the Province. Comparing the returns of death, according to their causes, for Calcutta with those for Bengal towns, and for districts excluding towns, it is manifest that, whilst with regard to such causes as *injury* and *cholera*, which are recognised even by the most uneducated, the rates per thousand do not widely differ, it is much otherwise in the case of *fever*, *diarrhœa* and *dysentery*, and *other causes*. In Calcutta the death-rate ascribed to fever during the year under review was 11·21 per thousand of population; in the other towns almost exactly double; and in districts, excluding towns, 24·17. Likewise, the death-rate ascribed to diarrhœa and dysentery in Calcutta was 6·05, and in the other towns 3·50; whilst in districts it was only ·75. On the other hand, whilst Calcutta attributes to "other causes" a death-rate of 30·47, Bengal towns record under the same heading a rate of only 8·92; and districts, exclusive of towns, 5·78. If, for the reasons stated, the Calcutta returns be accepted as affording an approximately accurate record of deaths according to their causes, those for Bengal towns and districts, more particularly as regards such causes as fever and bowel complaints, differ from them so widely that they cannot be accepted as furnishing anything like a reliable measure of the real mortality from these diseases.

4. *Chief Diseases.*—The mortality from *cholera* was the highest on record in the Province since the introduction of the present system of registration of vital statistics. The excessive prevalence of the disease is attributed to opposite climatic conditions : early cessation of the rains in the previous year, followed by the absence of spring rain in the year under review, "brought about conditions favourable to cholera," whilst the abnormal rainfall in some districts during September washed the poorer people out of their houses, and polluted the water supplies accessible to them. And again, "The early cessation of the rains of 1900, and the consequent early subsidence of the rivers, led to a heavy mortality from cholera in most of the districts of Eastern Bengal." No doubt the conditions described and excessive cholera-prevalence co-existed, but evidence to show that the latter was due to the former is wanting. The endeavour to disinfect wells by means of the permanganate of potash created a panic in some places; the people, it is stated, forsook the disinfected wells and took to dirty puddles instead. Sanitary officers are not yet unanimous as to the effect on cholera of disinfecting the wells with permanganate of potash. The question can only be definitely settled by a series of experiments conducted on scientific principles, as suggested in the Government review of the Punjab Sanitary Report for 1895. Anti-cholera inoculation would appear to have been remarkably successful in conferring immunity from attack. Out of 1,527 coolie emigrants who were not inoculated at Goalundo, 32, or 2·09 per cent., got the disease ; whilst out of 873 who were inoculated, only two, or ·22 per cent., suffered from it. If these figures represent the degree of protection which anti-cholera inoculation is capable of conferring on those who undergo it, the expediency of inoculating all coolies before despatch to the Assam tea gardens can hardly be a matter of doubt.

5. A death-rate from small-pox of ·29 per thousand of population, though higher than that for the previous year, and higher than the average for the past ten years, cannot be regarded as excessive for the Province as a whole. But in certain districts, such as Cuttack, the death-rate was very high. The inhabitants of the Orissa Division, of which Cuttack is a district, still prefer inoculation to vaccination. Inoculation, which is practised chiefly among the well-to-do classes, keeps alight and diffuses small-pox contagion amongst those unprotected by vaccination, inoculation, or a previous attack of small-pox. The remedy would be to place vaccination within the reach of all, and to suppress inoculation. Vaccination made good progress during 1900–01 ; the number of operations exceeding the number in the preceding year by 93,730, and the percentage of successful cases having been slightly higher in primary vaccination, and considerably higher in re-vaccination. But, as an indication of how much remains to be done before Bengal can be regarded as a well-vaccinated province, it is only necessary to state that, of 3,117,036 infants under one year of age estimated to have been available for vaccination in the year under report, only 589,376, or less than one out of every five, were successfully vaccinated. Human lymph is still chiefly employed in Bengal, but fresh calf lymph, and lymph preserved with lanoline, are also used to a considerable extent. The results show that fresh calf and humanised vaccine lymphs give nearly the same percentage of successful cases, whilst lanoline lymph gives a much lower percentage of success than either of the other two kinds.

6. The death-rate from *fever* was slightly higher than that recorded for the previous year, and considerably higher than the average rate for the past ten years. Accompanying the increased mortality from fever, there was no corresponding increase, but, on the contrary, a slight decrease, in the quality of quinine sold.

7. The recorded number of deaths from *diarrhœa* and *dysentery* represents almost certainly only a fraction of the actual number. In places like Darjeeling and Calcutta, which return the highest death-rates from these diseases, there is doubtless a more intelligent differentiation of the causes of death than in the districts of Rajshai and Jessore, which return the lowest rates. The death-rates from bowel complaints in the two former districts were 6·33 and 6·05 respectively ; and in the two latter districts only ·05 and ·04 respectively, per thousand of population. The latter figures are obviously worthless except as indicating the backwardness of registration of deaths according to their causes.

8. The deaths recorded under the heading "other causes" have much increased during the past two years, as they have likewise been shown to have increased in the Bombay Presidency since *plague* began to appear there towards the end of 1896. The Sanitary Commissioner states his belief that "plague deaths are generally returned under this head and so to have swelled the death-rate attributed to 'other causes.'" The returns for the year show that, including the figures for Calcutta, the seizures from plague numbered 40,294 and the deaths 38,412. But, taking into account the Sanitary Commissioner's statement above quoted, much confidence need not be placed in the accuracy of these figures. Perhaps the most hopeful circumstance noted in connection with plague in Bengal is the growing tendency of the people to voluntarily adopt measures to protect themselves against infection.

9. *Sanitary Works.*—Various projects were referred to the Sanitary Board during the year with the object of improving the water-supplies and drainage of towns. Of these the most important was the scheme for a combined water-supply to the riparian municipalities.

10. *Summary.*—The Report has the merit of of brevity and also some of its defects. The year was unhealthy. The mortality from all of the chief diseases was greater than in the previous year, and greater than the average of the past ten years. High prices of food influenced both the birth and death rates, tending to lower the former and to raise the latter. Cholera swept off a greater number of people than in any previous year since the introduction of the registration of vital statistics. The severity of the epidemic is attributed mainly to climatic conditions. Absence of rain, and excess of rain, were both, it is stated, favourable to cholera prevalence. The death-rate from small-pox, though higher than usual, was not excessive, except in districts in which inoculation is practised and preferred by the people to vaccination. In such districts, when vaccination has been placed within the reach of all, there would appear to be no valid reason against the suppression of inoculation. The mortality from diarrhœa and dysentery was higher than usual ; but there are reasons for believing

that the recorded death-rates attributed to these diseases do not represent, even approximately, the actual rates. According to the Sanitary Commissioner, deaths from plague are generally returned under the head of fever; if such be the case, the plague mortality returns must be accepted with reserve. The most important of the sanitary schemes under consideration, that for providing a combined water-supply for the riparian municipalities, would be of the utmost benefit to the populations concerned. The scheme will be costly, and the chief difficulty in carrying it out, the provision of the necessary funds.

24th April, 1902.

No. 3.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of the North-Western Provinces and Oudh for the year 1900.

The Report covers only 14 pages, or little more than half the maximum number prescribed by the Government of India. The year was a very healthy one. The birth-rate of 40·34, per thousand of population, although much below that of the previous year, was still considerably higher than the mean rate for the previous five years. Whilst the birth-rate decreased from 48·09 in the preceding year to 40·34, the death-rate at the same time decreased from 33·19 to 31·13, and was below the quinquennial mean. A decrease of the death-rate is, under ordinary conditions, a normal accompaniment of a decrease of the birth-rate. But for the unusually high birth-rate of the preceding year, the effect of which would continue to influence the mortality returns of the year immediately following, the death-rate of 1900 would doubtless have shown a still further decline. The births during the year under review exceeded the deaths by 432,030, a number which represents the natural increase of the population.

2. In paragraph 15 of the Report the infantile death-rate is stated to have been 219·2; but on referring to Annual Form No. IV. in the Appendix, the ratio of deaths of children under one year of age, per 1,000 living, is seen to be 286·96 for males and 267·00 for females. If the infantile death-rate is calculated on the number of births during the year under report instead of on the number of children under one year of age according to last census, it will be found to be 240·2 per *mille*. For the previous year the infantile death-rate similarly calculated was 230·5. The death-rates among children under one year of age during each of the two years 1899 and 1900 are thus seen to approximate much more closely than the figures in paragraph 15 of the Report would indicate. How these latter are arrived at is not clear. If the number of children under one year of age, according to last census, is used in calculating infantile death ratios, a glance at the figures in paragraph 15 will show that the smaller number of deaths in 1898 is made to yield a higher ratio of deaths than the larger number in the year under report.

3. Returns of deaths, the causes of which have been verified by medical officers, medical subordinates, and medical practitioners, have been, as usual, obtained during the year under report. The total number of these cases was 11,321. Of these, 2,022 were attributed to malarial fevers, and 2,122 to dysentery and diarrhœa. The deaths from the latter two diseases were, thus, more numerous than those from malarial fevers. In the provincial returns the recorded death-rate from fevers was 23·58; whilst that from dysentery and diarrhœa was only ·65, per thousand of population. Although it would be unsafe to draw general conclusions from numbers so small as those in which the causes of death have been verified by qualified medical practitioners, yet, so far as they go, the results, like those obtained in previous years, tend to show that, whilst the provincial returns overstate the mortality from fevers, they greatly understate that due to bowel complaints. Amongst the 11,321 deaths, the causes of which were verified by medical practitioners, 19 were ascribed to enteric fever in the year under report, as compared with seven out of 9,684 deaths in the previous year. It does not appear that any of those deaths from enteric fever occurred amongst the 4,794 children under 16 years of age. The systematic check of registers and the infliction of fines for neglect to record births and deaths have, by degrees, been effectual in these provinces in rendering the returns of vital statistics approximately accurate as regards mere numbers; but the same cannot be said of the causes assigned for the deaths recorded in the returns; and with the agencies available for ascertaining these causes, it is not probable that this defect in registration will soon be overcome.

4. *History of Chief Diseases.*—The deaths due to *cholera*, which had numbered only 2,508 in 1898 and 8,142 in 1899, increased to 84,960 in the year under review. The causes to which these great variations in the prevalence of cholera from year to year are due, have yet to be discovered. A suggestive remark is made by the Sanitary Commissioner in paragraph 30 of his Report, when noting the absence of cholera at the great fairs held during the year. "In past years these gatherings were constantly the origin of widespread sickness and death. It is difficult to attribute the immunity from such outbreaks in recent years to anything but improved and systematic sanitary measures."

5. Small-pox deaths decreased in number from 2,096 in the preceding year to 1,410 in the year under report. The latter number yields a mortality rate of only ·03, per thousand of population, the lowest hitherto recorded for the Province. Vaccination made good progress, in spite of the need for caution in carrying out vaccine operations in those parts of the Province where plague prevailed, and of the deputation of some of the most experienced vaccinators on plague duty. The percentage of success was high both in cases of primary vaccination and of re-vaccination. "Calf lymph is only used at present to a small extent, arm-to-arm vaccination being generally practised throughout the Province." Arrangements are, however, being made for the provision of bovine lymph in sufficient quantity to make recourse to the use of humanised lymph no longer necessary.

6. The death-rate from *fever* decreased from 26·55 in the previous year to 23·58 in the year under report. *Diarrhœa* and *dysentery* are credited with only 30,652 deaths; but, as already remarked, the actual mortality from these two diseases is probably far greater than the returns would indicate.

7. The Sixth Annual Report of the Provincial Sanitary Engineer gives a detailed account of the sanitary works executed during the year. These consisted largely of improvements and repairs in connection with waterworks already completed. The Benares drainage scheme made substantial progress, and the question of the best method of disposing of the sewage of Cawnpore was gone into. With regard to sanitation, Colonel Thomson says:—"Many sanitary improvements have been effected, not only in the larger cities and towns, where special sanitary and health officers were employed, but also in rural areas, which have been visited from time to time by medical and other officers in connection with plague preventive measures."

8. *Summary.*—Judged by its birth and death rates, the year was prosperous and healthy. The birth-rate did not reach the exceptionally high level of the previous year, but was still over 40 per thousand of population. The death-rate fell along with, and partly doubtless as a result of the fall in, the birth-rate. In all probability it would have been still lower but for the unusually large proportion of infants in the population consequent upon the high birth-rates of the previous year and of the year under report. It is not understood how the "death-rate of infants" given in paragraph 15 of the Report is arrived at. The Government of India are not inclined to accept anything below a death-rate of 300 as being an approximately true figure of the infantile death-rate in India. The deaths from cholera, which were only 2,508 in 1898 and 8,142 in 1899, numbered 84,960 in the year under review. Some attempt might have been made to explain why, after remaining for two years in comparative abeyance, cholera should have broken out with such violence in the year under report. The small-pox mortality of the year is the lowest on record, a result which may fairly be credited to the progress and efficiency of vaccination. The results obtained from the records of deaths, the causes of which have been verified by qualified medical practitioners, support the belief that the number of deaths attributed to diarrhœa and dysentery in the provincial returns is much understated, and the number attributed to fevers overstated. No new sanitary works of magnitude were commenced during the year; but much was done to improve and perfect existing waterworks and to advance towards completion the great drainage scheme at Benares.

24th April, 1902.

No. 4.

MEMORANDUM by the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER of the PUNJAB for 1900.

In accordance with the orders of the Government of India the length of the Sanitary Report for the year has been much reduced. It does not much exceed half the maximum length of 20 pages, to which it has in future to be limited. The year was one in which the population of the Punjab suffered severely from the combined effects of famine and sickness. The only other Indian provinces in which higher death-rates were recorded were those of Bombay and the Central Provinces; and in both scarcity and famine were more widespread and severe than in the Punjab. Instead of wages rising as the price of food rose, labourers "were found willing to work for lower wages owing to increased competition during the famine."

2. The *birth-rate*, although lower than in the previous year, was still higher than in any other Indian province. This result the Sanitary Commissioner attributes "entirely to the effective method of registration." Without denying to efficient registration its share in bringing about the record of a high birth-rate, it is certain that the growth of the population since the previous census was taken must have exercised a decided effect in raising both the birth and death rates recorded for the year under review, the last of the ten inter-censal years. The census figures for 1891 are used in calculating birth and death rates; but the new census figures for 1901 show that the population of the British part of the Province has increased during the past 10 years by upwards of a million and a half, or at the rate of 7·57 per cent. The district of Jhang furnishes an example of the effect on the birth-rate which increase of the population since the previous census may produce. The birth-rate recorded for Jhang in the returns for the year under review is 77·7 per thousand, calculated on its population figures of 1891. But the census of 1901 shows that, during the preceding 10 years, the population has increased by no less than 734,625. If calculated on the census figures of 1901 the birth-rate works out to be, not 77·7, as recorded, but only 28·98.

3. The *death-rate* rose from 29·57 in the previous year to 47·7 per thousand of population. This increase is ascribed to famine, cholera, and fever. If in calculating it the census figures of 1901 are used, the death-rate, like the birth-rate, will be found to be lower than that obtained by calculating it on the population figures of the previous census. Using the census figures of 1901 the death-rate works out to be 43·9, and using the census figures of 1891 to be 47·7. The famine-stricken districts show, as might be expected, the highest death-rates. In the Hissar district, in which to severe famine was added an epidemic of cholera, the death-rate rose to 96·4 per *mille* of population. An examination of the returns of deaths shows that, whilst the number of male children born exceeds the number of female children born, yet in some districts the number of the latter who die under one year of age exceeds the number of the former. In the three districts of Jullundhur, Ludhiana and Amritsar, this excess of mortality amongst female infants is a constant feature of the returns from year to year. The fact, as observed in the Government review of the report, "cannot be without its significance."

4. *Chief Diseases.*—Of deaths from *plague* 495 were reported, as compared with 227 in the previous year. *Cholera* prevailed in severe epidemic form, and accounted for 28,260 deaths, yielding a death-rate of 1·37 per *mille* of population, as compared with an average of only 0·08 for the previous five years. "The severity of the epidemic," writes the Sanitary Commissioner, "was due in great measure to the presence of famine in the Province." Yet, the history of cholera in other years and provinces shows that the prevalence and severity of this disease may bear no proportion to the degree and severity of famine. In the year 1897 widespread and severe famine prevailed in the North-Western Provinces, yet, although cholera was present, it was less destructive of life than in years when there was no famine. In 1897, in those provinces the cholera death-rate was only 0·94 as compared with 1·47 in the previous year, and with an average for the five previous years of 2·16. Similarly, although Bihar was the most severely famine-stricken part of Bengal in 1897, it recorded a lower death-rate than any other division of the Province. The attempts made to explain the origin of the outbreaks of the disease in the Punjab have not been attended with much success. In the district of Hissar, which suffered much more severely than any other in the Province, "the disease was reported to have broken out on the 13th December, 1899, in consequence of the contamination of a tank, the water of which was used by famine relief labourers, but it is not known how the tank was contaminated." So, with regard to the instances in which the origin of outbreaks was ascribed to importation, "the evidence," writes the Sanitary Commissioner, "is of so conflicting a nature that no reliance can be placed on it."

5. *Small-pox* caused 10,425 deaths, or a ratio of 0·51 per *mille* of population. The numbers vaccinated during the year show a great falling-off as compared with the numbers for the preceding year. The decrease, which amounted to 160,578, is attributed to the decrease in the number of births, and to the fact that in the preceding year the numbers vaccinated were much in excess of the annual average. Of the total of 592,824 successful primary vaccinations, no fewer than 462,392 were performed on children under one year of age; and as the number of children born in the year under report fall short by 150,031 of the number born during the previous year, it is evident that the diminished birth-rate must have had a marked effect in diminishing the number available for vaccination. The large proportion of infants vaccinated is a favourable feature of vaccination work in the Punjab. The results obtained from the use of vaccine lymph preserved with glycerine have been disappointing. In the two districts of Umballa and Rawal Pindi, for which returns are given in Appendix C., the percentage of successful, excluding "unknown," cases was only 92·30. It might be found expedient to adopt in the Punjab the method of lymph preservation with glycerine which Colonel Campbell found to yield so successful results in Assam.

6. *Fever* is credited, as usual, with having caused by far the greater proportion of the deaths from all causes. According to the returns, 70 per cent. of all the deaths were due to it; but no doubt a large number of deaths due to other causes are registered under this head. The fever death-rate, which averaged during the previous five years 19·54 per *mille* of population, rose during the year under report to 33·37. In the severely famine-stricken district of Hissar it reached the high ratio of 70 per thousand. The Sanitary Commissioner says the rise in the fever mortality took place in September in consequence of the heavy rainfall in that month. The deaths ascribed to it in the following two months exceeded a quarter of a million.

7. The ratio of mortality from *diarrhœa* and *dysentery* rose from 0·53, the average for the previous five years, to 1·26 per thousand of population in the year under report; but it is probable that the actual death-rate from these scourges of communities suffering from scarcity of wholesome food was far higher than that recorded. The very useful return published year by year in the Sanitary Report of the North-Western Provinces, embodying the results of the verification of deaths by qualified medical men, shows that, there at least, the proportion of deaths due to diarrhœa and dysentery probably far exceeds the proportion shown in the general provincial returns; and that, on the other hand, the proportion ascribed to fever is greatly overstated.

8. The amount of money expended on them affords, perhaps, the most reliable measure of the progress being made in the improvement of the water-supplies and drainage of the towns of the Province. The total municipal income for the year exceeded 46 lakhs of rupees; and from this amount a sum of less than three lakhs was devoted to the improvement of the water-supplies, and just over a lakh to the improvement of drainage. From this it may be concluded that no sanitary work of magnitude was carried out during the year. The appointment, just made, of a Sanitary Engineer for the Province may be taken as an indication that sanitary works are, in future, to receive increased attention, and to be designed and executed on scientific principles.

9. *Summary.*—The year was unhealthy. Owing to the prevalence of famine and epidemic diseases, the mortality of the Province, as a whole, was abnormally high, and in some of those parts most severely afflicted by famine, excessive. Whilst the birth-rate decreased from 48·4 in the preceding year to 41·1 in the year under report, the death-rate increased from 29·5 to 47·7. For this increase of the death-rate fever was chiefly responsible. Fever by itself caused no less than 70 per cent. of the deaths from all causes, according to the returns. Cholera, which in the Punjab prevails in severe epidemic form only at long intervals, accounted for upwards of 28,000 deaths. Diarrhœa and dysentery had ascribed to them a death-rate of 1·26 per thousand of population, but the actual death-rate from these two diseases was probably much higher. Small-pox was more than usually prevalent and fatal. The numbers vaccinated during the official year 1900–01 greatly fell off, the decrease being ascribed, in part, to the decrease in the number of children born during the year. Plague deaths to the number of 495 were registered in three districts; this was more than twice the number recorded in the previous year. The appointment of a Sanitary Engineer for the Province may be taken to indicate an increasing appreciation of the importance of sanitary works, and a determination to have these designed and executed in accordance with scientific requirements.

24th April, 1902.

No. 5.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Burma for 1900.

The Report, which is clear and concise, covers only 17 pages. The sanitary history of the year did not much differ from that of its predecessor; both were healthy years. The Province suffered from no very serious outbreak of epidemic disease, and the number of deaths recorded was nearly the same in each of the two years.

2. Continued attention is being paid to the important work of *registration* of vital statistics and improvement is shown to be taking place; but the Sanitary Commissioner gives good reasons for believing that, in some cases at least, the scrutiny to which the registers of births and deaths are subjected by inspecting officers is wanting in thoroughness; "for it is scarcely possible that registration, especially in rural tracts, can be so very accurate that only one omission occurs in 4,761 entries, and no omissions in 4,085." In Upper Burma, except in some selected towns with a combined population of 311,605, registration of births has not yet been commenced; but the deaths are registered for a population of nearly two and a half millions. The ratio of births recorded in the selected towns approximates to the ratio for Lower Burma; but in the case of deaths it is only 21·80 as compared with 27·51. As regards deaths, at all events, it is clear from these figures that a large proportion of them must remain unregistered.

3. The number of *births* recorded during the year in Lower Burma shows a considerable increase over the number recorded in the previous year, and a large increase over the decennial mean. The birth-rate, which was 37·04 in the previous year, rose to 38·37 in the year under review. The number of births exceeded the number of deaths by 11 per thousand of population. The increased birth-rate may, in part, be due to improved registration; but there is little doubt that it is also, in part, due to growth of population since the census of 1891 was taken. This growth may not be altogether the result of what is termed "natural increase," or excess of births over deaths; but may, in part, be due to immigration. Unlike some congested parts of India, Burma has still room for a larger population than it yet possesses. Contrary to what might be looked for, the registration of births seems to be more defective in towns than in rural tracts. Whilst the birth-rate recorded in the former was only 27·55, per thousond of their population, in the country it was 39·06. In the Province as a whole, for every 100 births of female children there were 107 births of males. This proportion does not probably diverge much from normal, and may be accepted as another indication that, under persistent attention given to it, registration is making good progress.

4. The *deaths* registered in Lower Burma during the year numbered 172,714, or 943 over the number for the previous year. Calculated on the population numbers of the previous census this gives a ratio per thousand of 27·51 as compared with 22·44, the mean of the previous ten years. Improved registration and growth of population since last census, the factors assumed to have been chiefly concerned in raising the birth-rate of the year under review, were also probably those chiefly concerned in raising its death-rate. The mortality in towns was much higher than in the country; in the former the death-rate recorded was 32·70 as compared with 26·71 in the latter. The Sanitary Commissioner remarks that the towns in which the death rates were lowest also return low birth-rates, "due, evidently, to defective registration." The cause assigned may be the real one for the lowness of both the birth and death-rates recorded; but a low birth-rate normally accompanies a low death-rate, as a high birth-rate normally accompanies a high death-rate. By far the greater proportion of deaths was registered under the two headings, "other causes" and "fever." Together, these two contributed 23·92 of a total rate from all causes of 27·51.

5. Of the *chief diseases* none was unusually fatal during the year. *Cholera*, which is shown by the returns to be, in the words of the Sanitary Commissioner, "more or less always with us," accounted for a death-rate of ·77 per thousand of population, as compared with 1·11 in the previous year, and with a quinquennial mean of 1·09. The detailed reports submitted by Civil Surgeons are said to elucidate nothing new in the origin or spread of the disease; but "it may be remarked, however, that an impure or infected water-supply was usually associated with these outbreaks."

6. Like cholera, *small-pox* was less fatal than in the preceding year. The death-rate from this cause fell from 1·32 per thousand, in 1899 to ·68 in the year under review. The number of primary vaccinations for the official year 1900–01 fell from 456,762 in the previous year to 395,652; whilst the percentage of success fell, at the same time, from 94·71 to 91·69. Great as the decrease is, it is not to be deplored, if the Sanitary Commissioner is correct in assigning it to stricter supervision and to the check which the submission of falsified returns by the vaccinators has received. Vaccination can never be successfully carried on without a continual supply of good vaccine lymph; and unfortunately this does not appear to have been always available. The Sanitary Commissioner writes:—"The quality of lymph throughout the year was not satisfactory." Lanoline, glycerine and lanoglycerine were all used in the manufacture of the lymph. In last year's *memorandum* it was suggested that the process of manufacture adopted with such marked success by Colonel Campbell in Assam might be tried in Burma. Outside municipal limits the inoculator is free to practise his craft with impunity, the Courts having ruled that inoculation is not a punishable offence under the Penal Code. The consequence is, that the inoculator is said to be found working side by side with the vaccinator, often forcing the latter from the field and keeping up a perpetual source of small-pox infection. The Sanitary Commissioner, in consideration of the gravity of this evil, thinks the Government might interfere in the interests of the public safety to put a stop to inoculation. Now that vaccination has been made available for all, and as it is at least as effectual a protection against small-pox as inoculation, there would not seem to be any hardship or injustice in putting a stop to the practice of the latter.

7. The mortality from *fever* and *bowel complaints* was nearly the same as in the previous year, and also nearly the same as the mean for the previous five-year period.

8. Four cases of *plague* were reported during the year, but the measures adopted to prevent the communication of the disease to the indigenous population proved successful. Of the four cases, all of them imported, only two were definitely shown to be genuine cases of plague. Of the remaining two cases, although they were perhaps doubtful, the Sanitary Commissioner is not prepared to say that they were not plague. The successful endeavour to prevent the spread of plague was in no small degree due to the vigilance and energy of the Port Health Officer of Rangoon, a brief account of whose work is given as an Appendix to the Sanitary Report.

9. *Sanitary Works.*—"Prome was the only town on which anything appreciable was expended on water-supply or drainage." Several schemes for improving the water-supply of other municipal towns were under consideration. Of these the most important is that for the improvement of the water-supply of Rangoon. The present supply, which is obtained from two lakes, is not filtered and has been repeatedly pronounced by the Chemical Examiner to be unfit for drinking purposes. Within the catchment area of one of the two lakes "are several vegetable gardens where night-soil is used as manure, as well as the homesteads of the Chinese and Burmese gardeners who cultivate them." A new scheme is to be taken in hand without delay at a cost of over eleven lakhs of rupees. Chief features of this scheme are the discontinuance of the lakes as sources of supply, and the formation of another great storage reservoir, the water from which will pass into settling tanks and through filter beds before its distribution to Rangoon.

10. *Summary.*—The year, like its predecessor, was healthy. Registration of vital statistics continued to receive much attention. The births recorded in Lower Burma show an increase over the number for the previous year, and exceeded the number of deaths by 11 per thousand of the population. The death-rate was nearly the same as in the preceding year. None of the chief diseases was unusually prevalent or fatal. A few imported cases of plague were detected at Rangoon, but the disease did not spread to the indigenous population. Excepting the town of Prome, none of the other municipalities expended any considerable sum on the improvement of waterworks or drainage. A scheme is to be taken in hand without delay for providing Rangoon with a water-supply from another source, the supply at present obtained from the Royal Lakes having repeatedly been pronounced by the Chemical Examiner to be unfit for drinking purposes.

24th April 1902.

No. 6.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of the Central Provinces for 1900.

Before the preceding very healthy year had closed, there were indications that its successor would be one of unusual sickness and mortality. The failure of the rains of 1899 was followed by severe famine in the year under report, and in the company of famine came destructive epidemics of disease. The deaths were more than double the number recorded in the previous year, and more than the number recorded in any one of the previous 20 years, excepting only 1897.

2. The fluctuations in the *birth-rate* which have occurred during recent years in the Central Provinces furnish illustrations of the effects which conditions of distress, alternating with those of prosperity, exercise on fecundity. The period 1897–1900 includes two years of severe famine, and two years in one of which the birth-rate was the lowest and in the other the highest on record. It can readily be understood that, although, as regards deaths, the period of increased mortality would coincide with the period of famine, this might not be the case as regards births; some time would elapse after the commencement of famine before its effects would show themselves in a reduction of the number of births. During the year under report the birth-rate fell to 31·90 from 47·3 in the preceding year.

3. At the same time that the birth-rate fell so greatly, the *death-rate* more than doubled. This latter, which had been 28·09 in the previous year, increased to 56·75 in the year under review, but still fell far short of that recorded for the previous famine year of 1897, when it was 69·34. The Chief Commissioner in his review of the Report notices one of the reasons which might, in part, account for the lower mortality of the famine year 1900 as compared with that of the famine year 1897, notwithstanding that the "actual physical famine-producing conditions in 1897 were much less severe in extent and degree than in 1900." As he observes: "the power of resistance on the part of the population in 1900 would naturally be greater after an elimination of the weakly such as the famine of 1897 must have brought about." On the other hand, as a consequence of the abnormally high birth-rate of the preceding year, the population of the year under report contained an unusually large proportion of infants; and the mortality amongst infants being far higher than amongst those who have passed the period of infancy, this increase in their number conduced towards increase of the death rate. The number of infant deaths during the year under report "was extremely high, the total being 145,916, compared with 101,969 in the famine year 1897." In the Province, as a whole, the deaths at all ages and from all causes exceeded the births by 24·85 per *mille.*

4. The work of verifying the registration of vital statistics is said to have suffered no neglect in consequence of the extra strain thrown by famine relief operations on the officers of all departments of the public service. On the contrary, as regards deaths at least, it is believed that more than usual care was bestowed upon their registration. The Administrative Medical Officer, however, thinks it

more than probable that the figures recorded do not include all the births and deaths that occurred. The method adopted by the Native Superintendents of Vaccination for testing registration, described in paragraph 27 of the Report, would not fail, if rigorously carried out, to detect errors in the record of births and deaths. In the paragraph immediately preceding that just mentioned, there is a statement which seems to need explanation. "Of 48,603 births and 70,262 deaths reported by kotwars, it was found that 48,721 births and 70,294 deaths were recorded by the police." That is to say, the number of births and deaths entered in the register at the police station was greater than the number reported by the village watchmen. If the watchman's hand-book is written up in his village, the births and deaths in it are simply copied from it into the register at the police station. But, in some cases, the entries in the watchman's hand-book are not made in his village, because the watchman cannot himself write, and may be unable to find anyone in his village to write for him. In such a case, the watchman reports from memory at the police station the births and deaths which have taken place in his village since his last visit, and the clerk enters these both in the police register and generally in the watchman's hand-book as well. The agreement between the entries in a watchman's hand-book and the police register would, thus, be no guarantee of the accuracy of the registration of births and deaths. The village watchman might neglect to enter many of these events in his hand-book, or forget to report them to the clerk at the police station, and yet the hand-book and police register might agree. It seems desirable to explain this, as we read in paragraph 33 of the Report :—"The Civil Surgeon of Jubbulpore states that he compared the kotwar's books in 508 villages with the police registers, and that out of 6,857 births and 6,746 deaths entered in the former, he found 6,819 births and 6,775 deaths recorded in the latter." From this comparison the Civil Surgeon concludes that the "registration of births and deaths in the rural circles is wonderfully correct, and that in the cities and towns, with the exception of Murwara, it is also very correct." But such a method of testing the accuracy of the registration of births and deaths merely shows that the entries in the kotwar's books have been more or less correctly transcribed into the police registers; it is no proof that the kotwars have correctly reported the births and deaths in their villages. Only a house-to-house enquiry and a comparison of the result of such inquiry with the entries in the watchmen's books, or with the entries in the police register, can establish the accuracy or inaccuracy of the registration of births and deaths.

5. *Chief Diseases.*—The measures adopted with the object of preventing the spread of *plague* in the Central Provinces appear to have been attended with marked success. The number of deaths from plague only increased from 583 in the previous year to 590 in the year under report. "It is remarkable," writes the Sanitary Commissioner, "how these Provinces, lying as they do in the very pathway of, and surrounded by, infection, have so far, and with the slight exceptions mentioned, escaped the ravages of the disease."

6. *Cholera* was credited with 63,114 deaths; "but there is little doubt that many deaths occurred from cholera which were not reported as such, and what strengthens this opinion is the fact that the non-epidemic mortality rose directly cholera became general in March and April, and declined in September and October when cholera was dying out." The use of the permanganate of potash in the disinfection of the water supplies in localities in which cholera outbreaks occurred is reported to have been "generally attended with good results." The question of the efficacy of the permanganate of potash in cutting short cholera outbreaks by destroying cholera infection in the water supplies is one which, as we have noted in other memoranda, should be submitted to scientific investigation. At present, although many medical officers are convinced that the permanganate rarely fails to put a speedy end to a cholera outbreak, there are others who withhold their assent to this conclusion until definite proof can be produced in support of it.

7. *Small-pox* accounted for upwards of seven thousand deaths, or a ratio of 0·7 per 1,000 of population. From a remark made by the Administrative Medical Officer, he appears to imply that the invasion of the Central Provinces by small-pox was due to extension of the disease from the Bombay Presidency. "It made its entry from the Bombay side and invaded every district but one." But, apart from the circumstance that small-pox was less prevalent in the Bombay Presidency during the year under report than in the Central Provinces, the monthly returns show that in these latter no fewer than 10 districts were affected with the disease during the first month of the year, and between them recorded in that month 354 deaths. Some of these 10 districts, such as Sambalpur and Hoshungabad, are far removed from the Bombay side. The work of vaccination is stated to have been carried on during the year in a satisfactory manner; and, taking into account the difficulties it had to contend with in consequence of the prevalence of famine and pestilence, this was no doubt the case. But the number of primary vaccine operations was less by 66,141 than in the preceding year, although there was, on the other hand, an increase of 19,202 re-vaccinations. The percentage of successful primary and re-vaccination operations shows some decrease. The large decrease in the number of primary vaccinations is attributed to the diminished number of children born and the excessive infant mortality during the year. Although in the greater number of vaccine operations animal lymph was used, the returns show that arm-to-arm vaccination was practised in over a fifth of all the cases. The calves inoculated for the supply of vaccine lymph reached the enormous number of 10,228. One calf, on the average, would thus appear to have supplied lymph for the vaccination of only about 29 persons. As noted in last year's *memorandum*, in the Province of Assam one calf yielded sufficient lymph when mixed with glycerine to charge 1,047·46 capillary tubes. In the Central Provinces, a percentage of not more than 86·97 successful cases was obtained when glycerinated lymph was employed. The percentage of success resulting from the use of all kinds of lymph during the year was 96·97.

8. During a year in which scarcity of food was accompanied by scarcity of drinking water it was only to be expected that the mortality from *fever*, and especially from *bowel complaints*, would be great. The fever deaths, of themselves, exceeded in number those from all other causes of death together. No doubt, however, as the Administrative Medical Officer observes, many deaths due to other causes are recorded under the head of "fever," especially deaths due to acute diarrhœa or dysentery.

9. As the Chief Commissioner remarks, the Report might have been curtailed with advantage by the omission of details regarding sanitary works in rural and urban areas. Except in the town of Jubbulpore, no drainage work of magnitude was in progress during the year. In some of the other towns attention was directed to the improvement of the water supplies; but in a year of such stress, costly works of sanitary improvement would necessarily have to stand over until the return of more prosperous times.

10. *Summary.*—The year was a calamitous one. Famine and disease combined to raise the death-rate above that recorded in any one of the last twenty years, excepting 1897. The birth-rate fell from 47·3 in the preceding year to 31·90. Plague was still present, but owing doubtless to the measures taken to deal with it, showed little tendency to spread, and was credited with only about the same number of deaths as in the previous year. Cholera, small-pox, fever and bowel complaints were excessively fatal. The use of the permanganate of potash as a disinfectant of water supplies is believed by many medical officers to have been efficacious in cutting short outbreaks of cholera. The number of primary vaccinations greatly decreased; whilst that of re-vaccinations considerably increased. Glycerinated calf lymph gave a percentage of only 86·97 successful cases; and no fewer than 10,228 calves were inoculated for the supply of the Province with calf lymph. Yet, over a fifth of the total number of operations were performed with humanised lymph. In a year of scarcity of food and drinking water it was only to be expected that fever and bowel complaints would be unusually fatal. Excepting the drainage works at Jubbulpore, no others of magnitude were undertaken during the year. In some of the other towns attention was given to the improvement of the water supplies. Sanitary progress was retarded by the need for the employment of all available funds in combating famine and epidemics of sickness. The Report might have been considerably curtailed by the omission from it of details of sanitary improvements in rural and urban areas.

No. 7.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Assam for 1900.

Last year the Report covered 27 pages; this year it has shrunk to nine. No doubt, as the Chief Commissioner remarks, the former reports were too long; but the present one, he thinks, errs in the opposite direction. No mention is made of the rainfall or other chief meteorological features of the year, or of the prevailing prices of food; yet a report claiming to give even the briefest sketch of the sanitary history of a province, cannot well dispense with some allusion to the influence which climate and food supplies appear to exercise on the health of the people. It is stated that the health of the Province for the year was, on the whole, fairly good; and this statement is borne out by the comparatively low death-rate recorded.

2. Throughout the Report, the new population numbers of the recent census of 1901 are used in calculating ratios. The population, according to the previous census of 1891, numbered 5,050,590, and according to that of 1901 is now 5,275,249. Much attention continues to be devoted to the improvement of the registration of vital statistics. The statements given of the numbers of births and deaths checked in each district appear to show that the police afford very valuable aid in testing the accuracy of the registers. The same can hardly be said of the Inspectors of Vaccination; in four of the eight districts of the Province, these officers, as the result of their examination of the registers of births and deaths, failed to detect any inaccuracies. Judging from the number of births and deaths ascertained by the police to have been omitted from the registers in these same districts, it is more than probable that the checking of registers by the Inspectors of Vaccination was perfunctorily performed.

3. The provincial *birth-rate* of 34·96 shows a slight decrease when compared with that recorded for the previous year, when it was 35·45; but was higher than the rate recorded for any one of the three years preceding 1899, and higher than the average ratio of the 10 years ending 1896. A glance at Annual Form No. 1. in the Appendix reveals startling differences between the birth ratios of the several districts. Whilst Goalpara district records a rate of 41·06, everyone of the other five districts of the Brahmaputra Valley records a birth-rate of less than 30, and two of them rates of only 22·96 and 22·23 each. As registration has hitherto been stated to be more efficiently carried out in the Goalpara district than in any other districts of the Brahmaputra Valley, it may be inferred that the very low rates recorded in the latter are due, in part at least, to defective registration.

4. The *death-rate* for the Province was 30·64, per thousand of population. This is lower than the rate recorded for any of the other provinces of India except Burma and Madras. As in the case of the birth-rates, so in the case of the death-rates there are striking differences between those recorded for the several districts. Whilst Nowgong records a death-rate of 53·03 and Darrang of 44·09, the districts of Sibsagar and Lakhimpur record rates of only 20·78 and 25·62 respectively. As regards these two last districts, each records an abnormally ow birth-rate, the ordinary concomitant of a low death-rate. Disturbing causes may, however, upset this relationship between the birth and death rates. For example, the Nowgong district returns a birth-rate of only 27·91, per thousand of its population, whilst it returns a death-rate of 53·03. Besides being the most unhealthy of the districts of Assam, Nowgong was, during the year under report, visited by a destructive epidemic of cholera, which of itself swept off no less than 24·9 per thousand of its population.

5. *General History of the Chief Diseases.—Cholera* was much more fatal than in either of the two preceding years; the deaths attributed to it numbered 23,761 as compared with 8,380 in the previous year, and with 11,288 in 1898. In his report for the preceding year the Sanitary Commissioner

wrote :—"The incidence of the disease on tea gardens is always more severe than elsewhere ; in fact epidemics frequently start from them, and as most batches of coolies coming up by steamer or rail are infected, it is no wonder the managers cannot keep their estates clear." In his Report for the year under review we find :—"It is worthy of note that instead of the rate for cholera in tea gardens being higher than in other parts of the Province, as is generally the case, in the year under review it was much less." Conclusions drawn from the history of cholera in previous years are liable to be upset by its behaviour in succeeding years. As bearing on the importation of the disease in Assam by infected coolies coming from other provinces, a remark made by the former Sanitary Commissioner in his account of the severe epidemic of 1897 is worth quoting :—"The Surma and Brahmaputra Valleys are within the endemic area, and, in accordance with ordinary experience, deaths from this disease were registered in all the districts of these two valleys in each month of the year." The table given in the fifth paragraph of the Government review of the Report, shows the number of deaths from cholera amongst immigrant coolies on the steamers and at the depôts for the past five years. These deaths increased from 92 in the previous year to 528 in the year under report, notwithstanding the greatly improved sanitary arrangements effected in recent years on the steamers conveying tea-garden coolies to Assam. The state of health of these immigrant coolies at the time of their embarkation cannot fail to influence their death-rate. Quoting from the Chief Commissioner's Review of the Report :—"It is presumed that the heavy mortality is due to the large number of famine-stricken coolies who were predisposed to disease." An examination of the table referred to shows that the rise and fall of the cholera death-rate among immigrant coolies accompanies a corresponding rise and fall in the cholera death-rate for the Province. The significance of this relation might point to opposite conclusions. The greater prevalence of cholera amongst immigrants might be taken, by those who support the doctrine of importation of cholera infection, to be the cause of the greater prevalence of the disease amongst the provincial population. On the other hand, the greater prevalence of cholera among the coolies might be assumed to be the result of their entry into a country already infected ; cholera being shown to be endemic in Assam. A feature of the year's history of cholera was the disappearance of the disease, "almost as if by magic," after the sudden outburst which took place in March and continued until the end of June. Had any special measures, such as the disinfection of the water-supplies by permanganate of potash, immediatety preceded this sudden disappearance of cholera, such measures would not unnaturally have been given the credit of having cut short the outbreak.

6. The number of deaths due to *small-pox* decreased from 1,453 in the preceding year to 975 in the year under review. Of this disease the Sanitary Commissioner writes :—"Now, I think I may fairly say it plays quite an insignificant part in producing mortality in any portion of the Province, as is clearly shown by the statement printed in the margin." The comparative immunity of the Province from small-pox mortality, he thinks, "speaks volumes for efficiency of the work of vaccination." The Report on vaccination for 1900-01 shows that there was a slight falling-off in the number of primary vaccinations and of re-vaccinations, accompanied by a very considerable falling-off in the percentage of successful cases. In primary vaccination the percentage of success decreased from 98·50 in the previous year to 95·99 in the year under report ; whilst in re-vaccination it decreased from 88·90 to 79·99. The first two supplies of lymph sent out at the beginning of the working season are said to have been, for some unknown reason, of inferior potency, and their use to have been followed by a large number of failures. It is added that, under the insistance on more rigid rules and supervision, the normal efficacy of the lymph was promptly restored.

7. The mortality from *fevers*, which had decreased in the previous year to 18·04 per thousand of population, from 20·95 in 1898, still further decreased in the year under review to 14·70. Accompanying this decrease the returns show a steadily diminishing prevalence of the fatal form of fever known as *kalá-ázár*. The number of deaths recorded under the head of *kalá-ázár* has fallen from 18,597 in 1897 to 9,012 in the year under report. The Sanitary Commissioner in his previous report expressed the opinion that the epidemic of this disease might be said to be surely, if slowly, ceasing.

8. The death-rate from *diarrhœa* and *dysentery* was almost the same as in the previous year ; in 1899 it was 2·75 and in the year under report 2·84. The Sanitary Commissioner is unable to understand why these diseases should be so much more fatal in some districts than in others, and is inviting the special attention of civil surgeons to the solution of this question. Whilst the Goalpara district returns a death-rate from diarrhœa and dysentery of only 0·33 per thousand of population, Sibsagar returns a rate of 5·65, and Lakhimpur of 7·70. Possibly, the difference may be, in part, due to difference in diagnosis. It is almost, or altogether, incredible that in the Goalpara district, out of a total death-rate from all causes of 84·45, only 0·33 should be due to diarrhœa and dysentery.

9. *Sanitary Works.*—"No very large sanitary work was undertaken last year, and there is at present no provincial scheme of any importance under consideration." The list of sanitary improvements in rural areas shows that, with the funds available, a good deal is being done towards the improvement of the water-supplies by the construction of wells and the excavation of new tanks, or the repairing, cleansing, and protecting of existing ones. The money could not be spent to better purpose than in improving the water-supply. The total amount, Rs. 10,685, expended by the nine municipalities of the Province on drainage seems small, as does the total of Rs. 21,700 on water-supplies. But much cannot be expected of municipalities with populations ranging from only a little over 4,000 to less than 15,000 each.

10. *Summary.*—The Report has, in accordance with the orders of the Government of India, been much abbreviated. The year was, on the whole, a fairly healthy one, apart from the severe epidemic of cholera which carried off upwards of twenty-three thousand of the population. There was decreased mortality from small-pox and from fever ; the fatal form of the latter disease, known as *kalá-ázár*, seems to be gradually disappearing from the Province. No large sanitary work was carried out during the year ; but in rural circles the improvement of the water-supplies, more especially, received much attention.

24th April, 1902.

No. 8.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Madras for 1900.

As in the previous year, the Reports of the Sanitary Board, of the Sanitary Commissioner, and of the Sanitary Engineer are published together in the same volume. The first of these three is the only one which has been curtailed in accordance with the instructions of the Government of India. These instructions did not reach the officers who prepared the other two in time to admit of their being carried into effect.

2. The total rainfall of the year exceeded that of the previous year by 7·57 inches; but was less than the average for the ten years ending 1897. The rise in the price of food grains, which began towards the end of the preceding year, became more marked in the year under review. The price of the staple food grains of each district, of the Presidency in general, verged on the famine rate and this rate was actually reached in five districts. On page 13 of the Report a table is given showing, in two selected districts, the close relation in which high prices of the chief food grains and high death-rates stand to each other.

3. Whilst the birth-rate, which was chiefly influenced by the conditions prevailing during the previous year, rose to 31·8 per thousand of the census population, and was the highest on record, the death-rate, mainly owing to increased mortality from cholera and fever, rose from 20·1 in the previous year to 23·4. Both the birth and death rates recorded are still, doubtless, much below the actual rates, owing to defective registration. But a reference to the table in paragraph 13 will show that, in the case of births more particularly, a marked improvement has been effected in registration since 1892, when the birth-rate recorded was only 25·1 as compared with 31·8 in the year under review. The death-rates recorded in four districts were under 20 per *mille* of population. Such figures only show how backward registration still is in certain parts of the Presidency. Towards the close of the year, registration of vital statistics was made compulsory in about 400 villages. In the 61 municipalities of the Presidency the birth-rate recorded was 38·5, and the death-rate 34·4; the former being 6·7 and the latter 11·0 in excess of the provincial rate. These figures need not be taken as conclusive proof that fecundity and mortality are greater in towns than in the country; but rather as indicating that registration of vital statistics is more efficiently carried out in the former than in the latter. As a matter of fact, the birth-rate of rural populations is usually higher than that of urban populations, and probably would be found to be so in Madras, as elsewhere, were registration of births effected with the same accuracy in the country as in the towns. A provincial death-rate of only 149·2 recorded for children under one year of age, supports the Sanitary Commissioner's conclusion that "one cause of deficient death-rate is certainly a tendency to ignore the deaths of infants below one year of age." The recorded infantile death-rate for the municipalities during the year under report was 223·3; and even this, although greatly higher than the rate recorded for rural areas, is probably considerably less than the actual rate.

4. *Chief Diseases.—Cholera* was credited with 60,662 deaths, or rather more than twice as many as in the previous year. The inhabitants of town circles suffered more severely than the rural population, although it might be presumed that more attention would be given to the protection of the water-supply in towns than in country villages. The death-rate from cholera in town circles was 2·8, and in rural circles 1·8, according to the return on page 68, Appendix D., of the Report. It is stated that permanganate of potash, used as a means for purifying contaminated sources of water-supply, continues to be favourably reported on by medical officers. Experiments conducted on scientific principles are required to demonstrate the specific action of this chemical in disinfecting wells contaminated with the cholera poison. Although many medical officers have a conviction that cholera outbreaks are cut short, or modified, by the disinfection of the water-supplies by the permanganate of potash, there are others who maintain that the evidence in proof of this conviction is insufficient. It is important that the question should, if possible, be definitely settled.

5. *Small-pox* was more fatal than in the preceding year, accounting for 27,692 deaths, against 16,991 in 1899. Of the total number of deaths, 8,249 were those of infants under one year of age. The Sanitary Commissioner thinks the mortality from small-pox amongst infants "cannot be minimised without having recourse to legislation. Until vaccination is made compulsory in rural areas, more satisfactory results cannot be hoped for." It may be a question whether the advantages which would result from compulsory vaccination would compensate for the abuses to which its introduction might lead. Certain, however, it is that the death-rate from small-pox was three times greater in the country than in the towns. Vaccination made good progress during 1900–01. The numbers vaccinated and re-vaccinated exceeded those of the previous year by nearly one hundred thousand. This increase, although partly due to an increase of 20 in the number of vaccinators, was mostly the result of the greater amount of work performed by each vaccinator. Whilst in the previous year the number of operations performed by each vaccinator was 1,375, in the year under review it was 1,473, according to Statement No. 1 of the Appendix to the Vaccination Report. An unfavourable feature of vaccination in Madras is the low proportion of children under one year of age successfully vaccinated. Whilst in the Madras Presidency only 348,774 children under one year of age were successfully vaccinated out of a total of 1,044,250 persons of all ages, the number in the neighbouring Presidency of Bombay was 405,584 out of a total of 532,138 of all ages. The superiority of calf-to-arm vaccination over vaccination with calf lymph preserved by admixture with glycerine, or lanoline, is still very marked. Whilst lymph taken direct from the calf and applied direct to the arm gave a percentage of 98·8 successful cases, glycerinated lymph gave a percentage of only 91·5, and lanoline lymph a percentage varying from 88·5 to 93·4.

6. The mortality recorded under the headings of *fever*, *dysentery* and *diarrhœa* was greater than in the preceding year. The Sanitary Commissioner remarks that the low death-rates ascribed to fevers in plague-infected localities were probably due to a large proportion of the deaths from fever having been entered under the heading "other causes," to avoid the inquiry as to the cause of death, consequent on a report of "fever."

7. During the year the total number of attacks from *plague* throughout the Presidency was 895, of which 665 proved fatal; figures which appear to show that the system of passports, observation, and railway inspection has, so far, been effectual in checking the general spread of the disease in the Madras Presidency.

8. The scheme for training a sufficient number of certificated sanitary inspectors for employment by municipalities and district boards is one which might be adopted with advantage in other provinces. Already, of this class of men 16 are employed by district boards and 108 by municipalities. During the year, 51 men passed the practical and theoretical examination, after training in the Medical College; so that there is now available a total of 322 men holding certificates. This scheme for the training of a sufficient staff of sanitary inspectors is one of much promise; probably no other of equal practical importance to sanitary progress in India has in recent years been devised and carried into effect.

9. *Summary.*—The year was one of high prices of food grains, a condition shown to be closely related to the death-rate. The rainfall, whilst much in excess of that for the previous year, was still below the average for the ten years ending 1897. The birth-rate was the highest hitherto recorded for the Presidency, a circumstance probably due, in part at least, to the improvement which is steadily taking place in the registration of vital statistics. The death-rate was considerably higher than in the previous year; this was probably in part due to the hard times consequent upon high prices of food, and also, in part, to improved registration. The return of death-rates of less than 20 per thousand of population in several districts shows that much still remains to be done before a reliable record of mortality can everywhere be secured. Cholera accounted for twice as many deaths as in the previous year. Permanganate of potash is considered by medical officers to have been beneficially employed in the disinfection of wells during cholera outbreaks. It would be useful to have the specific effect of the permanganate of potash in the disinfection of water containing the cholera poison definitely demonstrated by a series of scientifically conducted experiments. Small-pox was more prevalent than in the preceding year. The number of persons vaccinated shows an increase of nearly a hundred thousand over the number for 1899–1900. Plague made little progress during the year, accounting for only 665 deaths throughout the Presidency. The scheme for training a staff of sanitary inspectors for employment in the Presidency is being successfully carried out, and is likely to have an important influence on sanitary progress.

24th April, 1902.

No. 9.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Bombay for 1900.

Barely had the Bombay Presidency recovered from the effects of the famine of 1896–97, when failure of the rains of 1899 led to a still more disastrous famine in the year under review. Although famine had begun to prevail before the end of 1899, it was not until the year under report that its effects came to be fully shown in the records of mortality. In its train came pestilence: plague, cholera, and fever carried off in great numbers a population enfeebled by scarcity. Subtracting the recorded number of births from the recorded number of deaths, the population is shown to have undergone, during the year, a diminution of 813,121. In other words, the deaths exceeded the births by this number. As remarked in the Government review of the Report, the year was the most unhealthy in the recent history of the Presidency.

2. A comparison is drawn between the population numbers ascertained by the recent census of 1901 and the numbers obtained by adding to the previous census numbers of 1891 the births registered since that year, and deducting from the total the deaths registered during the same period. Estimated according to this latter method, the population at the beginning of 1901 should have numbered 18,615,497, whereas the census just taken shows it to be 18,524,640. The approximation between the two sets of figures is fairly close, in spite of the fact that a detailed comparison shows wide divergences between the estimated and census population numbers in some of the collectorates. Notwithstanding these divergences, the result testifies to the general efficiency with which the registration of vital statistics was carried out during the past inter-censal ten years.

3. The small European and Eurasian population return, as usual, low birth and death rates. The death-rate, which among Europeans was only 12·5 per thousand in 1899, rose in the year under report to 20·1; whilst among Eurasians it rose at the same time from 21·72 to 28·9, showing that these two communities, although probably mostly above the reach of the famine conditions which directly or indirectly led to so high a rate of mortality amongst the native population, suffered nevertheless from the prevailing unhealthiness of the year.

4. The *birth-rate* recorded for the general population of the Presidency was 26·87 per thousand, the lowest for any of the past ten years. An examination of the table, given in paragraph 3 of the Report, will show that during the first five months of the year the birth-rate diverged but little from the average rate for the years 1890–99. This was only what was to be expected. Nine months prior

to each of the first five of 1900, scarcity had not begun to make itself felt, and the number of conceptions continued normal; but when the failure of the monsoon was followed by failure of the crops in the last months of the previous year, and famine had declared itself, the number of conceptions rapidly fell off. The table referred to shows that the number of births in each of the last seven months of the year under report was greatly below the average for the corresponding month of the previous ten-year period. The ninth month preceding each of the months returning a low birth-rate was one of severe famine; diminished fecundity kept pace with the progress of the famine. For the year as a whole the number of births was exceeded by the number of deaths in all except four districts of the Presidency. The percentage of children still-born to children born alive continues, as hitherto, to be very high in the city of Bombay. Whilst for the Presidency as a whole this percentage was only 1·66, in Bombay city it was recorded to be 16·46. But there are good reasons for believing that the registration of births is very defective in the latter. It is stated that still-births are unusually common in Kánara, and that this is "due to well known climatic causes." We do not recollect to have seen these climatic causes described.

5. The *death-rate* of 70·07 is almost exactly double that for the previous year, and considerably more than double the mean ratio for the previous five years. The Sanitary Commissioner is no doubt correct when he says, "This result is chiefly due to famine." Where, as in the Gujarat districts, the famine was most severe, there the mortality rate was also great. But in the Gujarat districts the enormous death-rate recorded was largely swollen by the tide of immigrants from adjacent Native States. The Deputy Sanitary Commissioner of the Gujarat Registration Circle "is inclined to attribute one-third of the total deaths to immigrants." To the same cause, the influx into them of famine-stricken people, was due the abnormally high death-rate in towns. Whilst the rural circles record a death-rate of 65·57, the urban circles record a death-rate of 102·33. Each of the specified causes of death, except plague, contributed to the increased mortality of the year.

6. *Cholera* accounted for no fewer than 163,889 deaths, and yet, as stated in the Government review of the Report, "there can be no doubt that the record is largely defective, and that the actual mortality from this cause was much higher." The ratio of deaths, per thousand of population, attributed to cholera was 8·71 as compared with a mean ratio of 1·75 for the previous five years. The disease was widely diffused over the Province: of the 220 rural circles only 18 enjoyed entire immunity from attack, and of the 56 town circles only five. Six pages of the Report are devoted to a history of the epidemic, but without throwing much light on the causes which led to widespread and fatal prevalence of the disease. An examination of the progress of the epidemic month by month shows that, as usual, the coldest months were those in which the disease was least fatal. In the four months January, February, November, December, only 2,676 cholera deaths were registered out of the total for the year of 163,889. From March the mortality increased until it reached its maximum of 44,521 deaths in July, after which it rapidly decreased. It has repeatedly been demonstrated that there is no necessary connection between cholera and famine, although when an outbreak occurs people enfeebled by want naturally offer less resistance to this, or to any other disease, than those in vigorous health. A perusal of the report leads to the same conclusion as that arrived at by the Deputy Sanitary Commissioner, Southern Registration District, as the result of his observation of the disease during the year. He writes: "No fresh light has been thrown on the causes of the disease in affected localities." The Deputy Sanitary Commissioner of the Gujarat Registration District, which suffered more severely than any other, expresses himself in somewhat similar terms. "It is impossible," he says, "to trace the origin of the outbreak. Imported, no doubt it was, but from whence or by what agency it was impossible to ascertain." On the other hand, there are some statements made by the Sanitary Commissioner which might lead to the belief that the origin of the outbreaks of cholera in particular localities had been ascertained with certainty. For example, regarding the death-rate we read in paragraph 42: "Ahmedabad cantonment was also in a famine district, but the increase is due to an outbreak of cholera owing to the drinking of impure river water." And again in paragraph 131: "It was in many cases impossible to prevent workers taking water from unauthorised sources, or bringing in unwholesome food, and so starting cholera, which, when it broke out, caused the people to scatter and infect other places." Unsupported by proof such statements do not, however, carry much weight.

7. The mortality from *small-pox* was the highest recorded for any one of the past ten years, but cannot be said to be excessive. The ratio of deaths per thousand of population due to this disease was 0·52, as compared with an average ratio of 0·12 for the previous five years. To the abnormal conditions which prevailed in the Province during the year a large part of the increased small-pox mortality was doubtless due. Not only was the work of vaccination seriously interfered with by the diversion from their own special duties of members of the vaccination establishment in consequence of the need for their employment in connection with famine relief measures, but the enormous influx of starving immigrants from Native States contributed, in some parts of the country, materially to swell the death-rate from small-pox. In the numbers vaccinated during the year there was a decrease of no less than 108,350 compared with the numbers for the previous year, a result partly due to the diminished number of births consequent upon the severe and widespread famine from which the Province suffered. The percentage of successful cases, excluding those "unknown," was 98·76, and cannot be regarded otherwise than as satisfactory. In re-vaccination the percentage of success recorded was 83·11. In spite of the adverse circumstances under which vaccination had to be carried on during the year, it is satisfactory to note that the number of infants successfully vaccinated in the Presidency "represents almost all the children available for vaccination." No better testimony to the efficient working of the Vaccination Department of a province could be offered.

8. Under the heading of *fever*, over half a million deaths were registered, or more than double the number registered in the previous year. The death-rate per thousand of population from this cause was 28·87, as compared with 12·14 in 1899. In the Gujarat Registration District the mortality from fever was excessive, a death-rate of 111·27 being recorded in one collectorate and of 167·77 in another. These figures must, however, be accepted with some reservation. The Sanitary Commissioner says:

"The returns from these two districts show serious defects in registration, and fever as a cause of death is much too frequently entered. The highest recorded number of deaths from fever in any month was in May, which is a very unusual occurrence, and may be partly accounted for by the fact that in this month also the cholera epidemic reached its greatest virulence, and many deaths from cholera were entered under the head of *fever*."

9. The number of deaths from *plague*, which in the previous year was 96,596, decreased to 33,196. As stated in the Government review of the Report, "these figures are very satisfactory"; but the subsequent history of the disease will show that any hopes founded on them of an early cessation of the epidemic would have been delusive. The returns bring out very clearly that the inhabitants of towns were the chief sufferers. Bombay city recorded 13,285 deaths, Poona 4,325, Belgaum 1,247, and Nasik 1,224, or between them 20,061; whilst the total for all the towns amounted to 22,087, leaving only 11,109 to be accounted for throughout the rest of the province.

10. That in such a year of distress the mortality from diarrhoea and dysentery would be great was only to be expected. The deaths from these diseases increased from 74,738 in the previous year to 218,243 in the year under report. The diseases, writes the Deputy Sanitary Commissioner of the Gujarat Registration District, "were most prevalent during and just after the rains, when damp and chills were added to the chief cause—unsuitable food." The same Officer adds, "The consumption of badly-cooked, half-cooked or raw grain, wild seeds, leaves, bark of trees, roots, &c., in fact, of almost anything solid which would help to fill the void; these are the chief causes of what was really an epidemic of dysentery and diarrhœa."

11. In last year's memorandum we commented upon the increase since 1896 in the number of deaths returned under the heading of *other causes*. This increase has continued during the year under report. From 100,112 in 1896, the number has now reached 342,027. Last year the number was 254,872; but as the total number of deaths from all causes in that year was only 672,289 as compared with 1,318,783 in the year under review, it is evident that the *proportion* of deaths registered under the head of "other causes" during 1900 has not only not increased but has greatly decreased. Had they been in the same proportion to the total deaths as in the preceding year, their number would have exceeded the recorded number by more than a third. This marked decrease in the proportion of deaths registered under the head of "other causes" in the year under review coincides, it will be observed, with a still more marked decrease in the number of deaths attributed to plague. In our previous memorandum on the Sanitary Report for the Bombay Presidency, it was suggested that the prevalence of plague might induce people to report deaths really due to fever as having resulted from "other causes," so as to avoid the troublesome inquiries which the report of an unusual number of deaths from fever might give rise to, fever being a prominent symptom of plague, and therefore likely to arouse suspicion and lead to search being made for cases of the latter disease. The decrease of plague mortality during the year may, on this hypothesis, have been indirectly connected with the decrease in the proportion of deaths registered under the head of "other causes."

12. In the year when the resources of the Province were being strained to the utmost in the combat with famine and pestilence, it was not to be expected that funds would be available for the prosecution of extensive sanitary works. In the words of the Government review of the Report:—"Owing to plague and famine local bodies were unable during the year to take up any projects of importance for the improvement of their sanitary arrangements."

13. The continued efficiency with which the duties of Port Health Officer were discharged during the year receives practical testimony from the fact that, although there were unfortunately outbreaks of plague at foreign ports, in no instance could these be traced to the crew or passengers on vessels from Bombay. Not plague alone, but epidemics of cholera and small-pox prevailed during the year, throwing on the Port Health Officer and his staff an unusual burden of work and responsibility. Besides the 13,286 deaths from plague, there were 4,273 from cholera and 3,018 from small-pox recorded in Bombay City during the year.

14. *Summary.*—The year was the most unhealthy in the recent history of the Presidency. Famine and pestilence caused excessive mortality, whilst the birth-rate was the lowest on record in any of the preceding ten years. The number of deaths exceeded the number of births by more than three-quarters of a million. In some parts of the country the death-rate was swelled by the large influx of starving people from the neighbouring Native States. An epidemic of cholera swept off 163,889 people; and it is believed that the actual mortality from this cause was even greater. Small-pox, although more fatal than in any year of the previous ten, was responsible for a death-rate of only 0·52 per thousand of population. It was only to be expected that in such a year the progress of vaccination would receive a check; the numbers vaccinated show a decrease, as compared with those for the preceding year, of upwards of a hundred thousand. Dysentery and diarrhœa were excessively fatal. Plague was the only disease which showed a substantial abatement. The *proportion* of deaths registered under the head of "other causes" was less than in the previous year, although the actual number was greater. The funds, which in a normal year would have been available for sanitary works, were swallowed up in the expenditure necessitated by the combat with plague and famine. Epidemics of plague, cholera, and small-pox in Bombay City threw a heavy burden of work and responsibility on the Port Health Officer and his staff. The measures adopted for preventing the spread of plague and other communicable diseases by ships proved eminently successful.

24th April, 1902.

No. 10.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner for the Hyderabad Assigned Districts for 1900.

Judged by its record of mortality, the year was the most unhealthy of any of the thirty years which preceded it. The death-rate was largely influenced by the severe famine from which the Province suffered throughout 1900. *Jowari*, the staple food grain of the people, which could be bought in the previous year at the average price of almost 23 seers per rupee, cost during the year under review a rupee for less than 10 seers, or considerably more than double. For 1899 a rainfall of only 12·92 inches was recorded, against 33·07 for the year under report. The failure of the rains in the former year was the cause of the severe famine in the latter.

2. It is stated that increased attention was given to the registration of vital statistics during the year. An examination of Table I., page 2, of the Report, reveals remarkable differences in the proportion per cent. of the registers found to be defective by the several inspecting agencies. Of the registers examined by Deputy Commissioners, a percentage of 1·5 only was found to be defective; whilst of those examined by District Superintendents of Police the percentage was 5·8; and of those by Civil Surgeons 9·6. Such wide differences would suggest that the same method of testing the accuracy of the registers is not followed by the different inspecting officers. The Sanitary Commissioner writes:—"I myself inspected 152 registers during the year, and found no omission." The nature of the inspection to which these 152 registers were subjected is not stated. If a house-to-house inquiry was made, and the births and deaths thus ascertained were compared with the entries of births and deaths in the registers, the result of this inspection would bear striking testimony to the completeness with which the registration of vital statistics is effected in Berar. It is only by a comparison of the entries of births and deaths in the registers with the births and deaths ascertained by a house-to-house inquiry that inaccuracies can, with any approach to certainty, be detected. If thoroughly carried out, this method of inspection necessitates much patient labour, and an expenditure of time which hard-worked officers, with other pressing duties, can ill spare. The Resident realises its importance, and "is glad to hear of the institution of house-to-house inquiry by inspecting officers in some districts, and hopes that it will be extended to all at a very early date."

3. The *birth-rate* fell from 50·5 per thousand of population in the previous year to 31·3 in the year under review. As the former was the highest rate on record for the Province, so we have to go back to the early seventies, when registration was less reliable than it is now, to find a lower birth-rate than that recorded for 1900. As the exceptionally high birth-rate of 1899 was the normal sequence of the conditions of prosperity and exceptional healthiness of the year immediately preceding it, so the exceptionally low birth-rate of the year under report followed the failure of the rains and crops in the last half of 1899 and the conditions of severe famine which ensued. "The low rates," writes the Resident, "was of course the result of the famine and its accompaniments."

4. The *death-rate* of 82·7 for the year was the highest on record, within the period for which trustworthy vital statistics are available. In 1878, under somewhat similar conditions of famine, the death-rate closely approximated to that of the year under report. It was then 81·5 per thousand of population. The Sanitary Commissioner succinctly sums up the causes of the excessive death-rate recorded for the year under report. These were, the severe famine which prevailed throughout the the year, the high birth-rate of the preceding year, the influx of starving people from the neighbouring Native State of Hyderabad, and an epidemic of cholera. The first of these, the severe and prolonged famine, was the principal cause of the excessive mortality of the year; the others were subsidiary and to some extent, at least, dependent upon it. The high birth-rate of its predecessor helped to raise the death-rate of the year under report by adding to the population an unusually great number of those most liable to death. The death-rate amongst children under one year of age was 478·5 per thousand, a proportion vastly in excess of that during any subsequent year of life. From this it is evident that the death-rate would usually vary with the proportion which the number of children under one year of age in the population bore to the total population. The third cause assigned by the Sanitary Commissioner for the increased mortality of the year, the influx into Berar of starving people from beyond its borders, would have the effect of raising the recorded above the real death-rate of the Province by the inclusion in the returns of deaths of persons not belonging to the provincial population. Examples are given showing the effect which this factor exercised in raising the death-rate of towns of the Province close to the borders of the Hyderabad State. In one of these towns, Pushad, the death-rate was swollen by the influx of starving people from Hyderabad territory to no less than 251·7 per thousand of its census population numbers.

5. *History of Chief Diseases.*—A severe epidemic of *cholera* accounted for 18,375 deaths, a number only three times exceeded in any of the previous 30 years. The Province enjoyed complete immunity from cholera during 1898 and until August of the following year, when cases began to occur. In January of the year under review the deaths attributed to it numbered 267; and from this time onward, except during March, when there was a temporary check in its progress, the mortality from cholera rapidly increased month by month until it attained its maximum in July. After this the mortality quickly decreased; in October only five deaths from cholera were registered; and in the last two months of the year, none. The epidemic was a continuation of the outbreak which began in August of the preceding year; and regarding the cause, or causes, of this outbreak nothing definite is known. The Sanitary Commissioner says that permanganate of potash was found to be "most invaluable in dealing with the cholera epidemic. As soon as cholera was reported from a village, a hospital assistant, if available, if not, a vaccinator, was at once sent off to the infected village with orders to disinfect all the water supply, and four or five days after the water supply had been disinfected the epidemic in almost every case ceased. This disinfection of wells answered admirably, and one was pretty certain to check an epidemic by it when the village water supply was

REPORT

ON

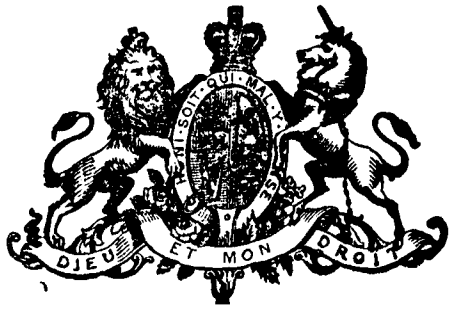
SANITARY MEASURES IN INDIA

IN

1901-1902.

VOL. XXXV.

Presented to both Houses of Parliament by Command of His Majesty.



LONDON:
PRINTED FOR HIS MAJESTY'S STATIONERY OFFICE,
By DARLING & SON, Ltd., 34-40, Bacon Street, E.

And to be purchased, either directly or through any Bookseller, from
EYRE & SPOTTISWOODE, East Harding Street, Fleet Street, E.C.,
and 32, Abingdon Street, Westminster, S.W.;
or OLIVER & BOYD, Edinburgh;
or E. PONSONBY, 116, Grafton Street, Dublin.

1903.

[Cd. 1850.] *Price* 1*s.* 6*d.*

CONTENTS.

REPORT.

	Page
I. European Army:	
Sickness and mortality in 1901 ...	5
In Commands.	5
In Groups of Stations	6
Cholera	6
Small-pox	6
Fevers	6
Bowel complaints	7
Abscess of the liver	7
Plague	7
Venereal diseases	7
Invaliding	7
II. Native Army:	
Sickness and mortality in 1901 ...	8
In Commands...	8
In Groups of Stations	9
III. General Population:	
Vital Statistics	10
Bengal	10
United Provinces of Agra and Oudh	12
Punjab...	13
North-West Frontier Province ...	14
Central Provinces	15
Burma	16
Assam	17
Madras...	18
Bombay	19
Berar	
IV. Jails:	
Sickness and mortality in 1901 ...	20
Bengal	20
United Provinces of Agra and Oudh	21
Punjab...	21
Burma	21
Central Provinces	22
Assam	22
Madras...	22
Bombay	22
Berar	23
V. Vaccination:	
General results	24
Bengal	24
United Provinces of Agra and Oudh	25
Punjab...	25
North-West Frontier Province ...	25
Burma	26
Central Provinces	26

	Page
V. Vaccination—*continued*:	
Assam	26
Madras...	26
Bombay	26
Berar	27
VI. Medical Institutions:	
Civil Hospitals and Dispensaries:	
Bengal	28
United Provinces of Agra and Oudh	30
Punjab...	30
North-West Frontier Province ...	30
Burma	30
Central Provinces	31
Assam	31
Madras...	31
Bombay	31
Berar	32
Lunatic Asylums:	
Bengal	32
United Provinces of Agra and Oudh	32
Punjab...	32
Burma	33
Central Provinces	33
Assam	33
Madras...	33
Bombay	33
Medical Schools:	
Bengal	33
United Provinces of Agra and Oudh	34
Punjab...	34
Madras...	34
Bombay	35
VII. Sanitation:	
Civil:	
Bengal	36
United Provinces of Agra and Oudh	36
Punjab...	36
North-West Frontier Province ...	37
Burma	37
Central Provinces	37
Assam	37
Madras...	38
Bombay	38
Berar	39

1625 Wt 7616 11/03 D S 6 15131

ABSTRACTS.

	Page.
India Sanitary Report for 1901 :	
Meteorology of the Year	43
European troops	45
Native troops	63
Jails	71
General population	76
History of chief diseases (including plague)	94
Vaccination	107
Sanitary works	114
General remarks	119
Madras Sanitary Report for 1901 :	
General population	129
Chief diseases	131
Sanitary works	133
Bombay Sanitary Report for 1901 :	
General population	135
Chief diseases (including plague)	137
Sanitary works	140
General remarks	140
Shipping and Health of the Port of Bombay	142
Calcutta Municipal Report for 1901–02	148
Calcutta Health Report for 1901	154
Madras Municipal Report for 1901–02	158
Bombay Municipal Report for 1901–02	163
Bombay Health Report for 1901	164

APPEND X.

Memoranda by the Army Sanitary Commission on :—	
India Sanitary Report for 1901	169
Bengal Sanitary Report for 1901	172
United Provinces of Agra and Oudh Sanitary Report for 1901	174
Punjab Sanitary Report for 1901	176
North-West Frontier Province Sanitary Report for 1901	177
Burma Sanitary Report for 1901	178
Central Provinces Sanitary Report for 1901	179
Assam Sanitary Report for 1901	180
Rajputana Sanitary, Vaccination and Jail Report for 1900	182
Madras Sanitary Report for 1901	184
Bombay Sanitary Report for 1901	186
Hyderabad Assigned Districts Sanitary Report for 1901	187
Calcutta Municipal Report for 1901–02	188
Madras Municipal Report for 1901–02	189
Bombay Municipal Report for 1901–02	191

A. GODLEY,
Under Secretary of State for India.

INDIA OFFICE,
November, 1903.

REPORT.

The present Report on Sanitary Measures in India during the year 1901 is prepared for presentation to Parliament. It contains chapters on the health of the European and Native troops, on the health of prisoners in jails, and on the health of the general population ; it also contains chapters on vaccination, on medical institutions, including medical schools and lunatic asylums, and a chapter on sanitary works. Appended to the Report are abstracts of reports by the three principal Sanitary Commissioners in India, and memoranda by the Army Sanitary Commission in England reviewing the several Sanitary Reports for India.

I.—EUROPEAN ARMY.

Sickness and mortality in 1901.

The health of the European troops serving in India during 1901 was on the whole good ; the admission, daily sick and death-rates were the lowest recorded for many years, but the invaliding ratio was higher. On an average strength of 60,838, the admissions into hospital were in the ratio of 1,104 per 1,000, against 1,143 in 1900, the daily sick-rate fell from 72 to 67, and the death-rate from 14·62 to 12·38. The invaliding ratio (39) was higher by 6 per 1,000, so that the total loss by death and invaliding was equal to 51 per 1,000, an increase of 3 per 1,000 on the previous year.

The following statement shows the relative extent of sickness and mortality among European troops in the four Commands during 1901 and the previous year :—

Commands.		Average Strength.	Ratio per 1,000 of Average Strength.				
			Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
Bengal	1901	19,000	980	62	12·95	37	50
	1900	18,956	1,075	70	13·40	33	46
Punjab	1901	16,431	1,090	63	12·90	38	51
	1900	16,562	1,085	65	12·62	27	40
Madras	1901	10,282	1,278	79	9·34	43	52
	1900	9,984	1,268	82	16·53	46	63
Bombay ...	1901	15,125	1,140	69	13·16	42	55
	1900	15,051	1,211	75	17·08	33	50
INDIA ...	1901	60,838	1,104	67	12·38	39	51
	1900	60,553	1,143	72	14·62	33	48

It will be seen from the above statement that Madras was the most unhealthy of the four Commands, Bombay coming next, though both compare favourably with the previous year. In regard to mortality, there was an improvement in all Commands except the Punjab, the decrease being most marked in Madras, where the death-rate fell from 16·53 to 9·34.

The chief causes of sickness in the whole European Army were, as usual, intermittent fever and venereal diseases, the former yielding a ratio of 293 per 1,000 against 308 in 1900, and the latter 276 per 1,000 against 298. More than a half (52 per cent.) of the total sickness resulted from these two causes. Enteric fever, as usual, was the chief cause of mortality, the death-rate from it being 3·32, which however is an improvement on 4·77, the ratio of the previous year. Twenty-seven per cent. of the total deaths were due to this cause.

Groups of stations.—The following table shows the sickness and mortality among the European troops according to groups :—

Groups.	Average Strength.	Ratio per 1,000 of Average Strength.		
		Admissions.	Daily Sick.	Deaths.
Burma Coast and Bay Islands	1,049	1,273	67	7·63
Burma Inland	1,906	1,672	97	13·12
Bengal and Orissa	2,025	1,139	75	23·70
Gangetic Plain and Chutia-Nagpur	6,160	938	58	13·31
Upper Sub-Himalayan	11,045	1,179	69	14·67
North-Western Frontier, Indus Valley, and North-Western Rajputana.	4,458	1,041	62	10·09
South-Eastern Rajputana, Central India, and Gujarat.	5,442	1,412	85	16·72
Deccan	8,630	1,203	79	11·94
Western Coast	1,552	831	54	5·15
Southern India	2,662	1,063	59	6·39
Hill Stations	8,692	781	49	8·63
Hill Convalescent Depôts and Sanitaria ...	3,184	1,303	81	13·51

Of the above 12 groups, six returned a higher daily sick-rate than that for the European Army as a whole, and in six groups the death-rate was greater. The most unhealthy groups, judged by the daily sick-rate, were Burma Inland and Central India, with daily sick-rates of 97 and 85 per 1,000 respectively.

Of the stations with a strength of over 1,000, the highest death-rates were those of Ferozepore (25·00), Umballa (20·42), Meerut (16·42), Peshawar (15·57), Allahabad (13·64), and Mhow (13·64).

Cholera.—There was very little cholera among the European troops, only 12 cases, all of which were fatal, having been recorded during the year, against 107 cases and 88 deaths in 1900.

Small-pox.—Among the whole of the European troops in India there were during the year under notice 20 cases of small-pox with three deaths. In the previous year there were 36 cases and three deaths.

Fevers.—From intermittent fever the admissions to hospital among the European troops in 1901 were in the ratio of 293 per 1,000 of strength, against 308 in the previous year. The death-rate was also lower, viz., 0·36 per 1,000, against 0·66 in 1900.

There was a further satisfactory decrease in the prevalence of enteric fever during the year. The admissions fell from 970 or 16·0 per 1,000 of strength to 776 or 12·8, which is the lowest recorded since 1887, and the deaths from 289 or 4·77 per 1,000 to 202 or 3·32. The decrease is attributed chiefly to the increased age of the average soldier, and his greater length of Indian service, due to the cessation of the usual reliefs and to the retention in the country of time-expired men. The reduction would also appear to be due to the greater care taken with regard to soldiers' food, drink, and sanitary surroundings, and to the absence of field service ; but it remains to be seen what effect the arrival of large drafts of young soldiers will have on the prevalence of the disease. Of the four Commands the Punjab recorded the highest mortality under this head, viz., 4·99, followed by Bombay 3·50, Bengal 2·58, and Madras 1·75. Among the larger stations with an average strength of over 1,000, Ferozepore returned a death-rate from this fever of 13·46, Peshawar 8·72, Umballa 8·17, Meerut 6·32, Quetta 4·09, Mhow 4·28, Secunderabad 3·77, and Lucknow 3·43. As usual, young and unacclimatised soldiers were the chief sufferers; among those from 20 to 25 years of age the death-rate was 4·91 per 1,000 against 6·85 in 1900, while among men between 25 and 30, and from 30 to

35, the mortality was 2·71 and 2·18 per 1,000 respectively. Among men of less than one year's residence in India the death-rate from this fever was 6·90 per 1,000, among men between one and two years 3·48, and among men between five and ten years' service 2·22 per 1,000. Of the total 202 deaths from enteric fever, 57 per cent. occurred among men between the ages of 20–25, and 35 per cent. among men between the ages of 25–30.

Bowel Complaints.—The admissions from dysentery and diarrhœa among the European troops were in the ratio of 35 per 1,000 of strength, or 9 per 1,000 more than in 1900. The mortality from dysentery was in the ratio of 0·97 against 0·86 in the previous year, and from diarrhœa 0·02 against 0·05. Dysentery was most prevalent, as usual, in the Bengal-Orissa group, but it was more prevalent in the Madras Command than in that of Bengal, though not so fatal.

Abscess of the Liver.—From abscess of the liver there were 101 deaths, giving a ratio of 1·36 per 1,000 of strength, against 94 or 1·57 in 1900.

Plague.—There were only three cases of plague among the European troops, and one death, against six cases and one death in 1900.

Venereal Diseases.—Venereal diseases ranked second in the list of causes of admission to hospital, and first in the causes of invaliding. They were the cause of 25 per cent. of the total sickness during 1901, and of 16 per cent. of the invaliding of the European Army of India. The admission-rate from venereal diseases per 1,000 of strength was 276·0, being 22·1 lower than in 1900 and 246·3 below the maximum rate (522·3) recorded in 1895. Various causes have been at work in bringing about this great reduction in the prevalence of these diseases, the chief being the increased age and experience of the men ; other causes have been the successful working of the cantonment general hospitals, the interest taken in the matter by regimental and other authorities, and lectures and warnings by medical officers, chaplains, and regimental officers. All the Commands shared in the decrease except Madras, where the ratio rose from 354·4 to 372·8 ; Bombay followed with 282·6, against 327·0 in 1900 ; Bengal 258·8, against 299·9 ; and the Punjab 229·1, against 235·8. The number of men constantly sick in hospital from these diseases was 1,416, against 1,630 in the previous year ; and the average stay of a case in hospital was about 31 days. The deaths from these diseases numbered eight, and the invalidings 383, against 14 and 380 respectively in 1900.

Invaliding.—The loss to the whole army by invaliding during 1901 amounted to 2,393 men, equal to 39·32 per 1,000, against 2,026 or 33·46 in 1900. The proportion of invalids to strength was as usual highest in the Madras Command (42·60), followed by Bombay (41·92), the Punjab (37·67), and Bengal (36·95). As regards the influence of age and length of residence in India upon invaliding, 42 per cent. of the total number invalided were under 25 years of age, against 52 per cent. in 1900, while 14 per cent. against 33 were of less than two years' service, and 60 per cent. against 72 were of less than five years' service.

II.—NATIVE ARMY.

Sickness and Mortality in 1901.—The health of the Native Army of India was on the whole also better than in 1900.

The ratios of sickness and mortality among Native troops in the five Commands during 1901 and the previous year are given in the following table :—

Commands.		Average Strength.	Ratio per 1,000 of Average Strength.		
			Admissions.	Daily Sick.	Deaths.
Bengal	1901	26,200	667	27	8·44
	1900	26,582	717	31	10·46
Punjab	1901	46,050	944	30	12·03
	1900	42,311	796	28	14·72
Madras	1901	18,022	697	28	8·80
	1900	20,407	690	30	12·69
Bombay	1901	22,428	933	35	12·93
	1900	24,908	957	35	18·71
Hyderabad Contingent	1901	5,826	543	21	4·81
	1900	6,260	561	22	12·62
INDIA	1901	122,806	829	30	10·68
	1900	123,463	785	30	14·04

Of the five Commands, Bombay was again the most unhealthy in 1901, though its death-rate of 12·93 per 1,000 was nearly 6 per 1,000 lower than in the previous year ; the Punjab returned the next highest mortality of 12·03. Pneumonia continued very prevalent in these two Commands, and the death-rates from it were 4·01 and 3·87 per 1,000 respectively.

The chief cause of sickness in the Native Army was ague, which caused 43 per cent. of the total admissions. Among the diseases from which the admissions to hospital were higher than in 1900 were influenza, malarial fever and respiratory diseases ; while from cholera, enteric fever, bowel complaints and venereal disease there was a decrease in the admissions. From cholera the admission-rate fell from 5·2 per 1,000 of average strength in 1900 to 0·3, and from venereal diseases from 42·5 to 34·3, as compared with 276·0 per 1,000 among European troops. There were 8 deaths and 128 invalidings from venereal disease, against 8 deaths and 383 invalidings among European troops.

Pneumonia was the chief cause of death in the Native Army, and contributed 25 per cent. of the total deaths, the death-rate being 2·72 per 1,000 of average strength, against 3·32 in 1900. From this disease the mortality among the Native soldiers was nearly five times as great as that among European troops (0·56 per 1,000). Fevers of all kinds were the cause of 14 per cent. of the total deaths, against 29 per cent. among the European troops. From ague, remittent and simple continued fevers, the deaths among the Native troops were in the ratio of 2·26 per 1,000, while among the European troops the proportion was 0·58. On the other hand, the death-rate from enteric fever among the Native troops was only 0·12 per 1,000, as compared with 3·32 among the European troops.

From cholera there were only 19 deaths in the Native Army, equal to 0·15 per 1,000 of strength, as compared with 390 or 3·16 in 1900.

During 1901 there were 70 cases of plague among the Native troops with 41 deaths, against 56 cases and 29 deaths in 1900.

Groups of stations.—The following statement gives the principal statistics of the Native Army, arranged in geographical groups, for 1901 :—

Groups.	Average Strength.	Ratio per 1,000 of Average Strength.		
		Admissions.	Daily Sick.	Deaths.
Burma Coast and Bay Islands	1,452	545	26	13·09
Burma, Inland	4,084	1,214	35	9·06
Assam	1,472	1,082	46	5·43
Bengal and Orissa	2,287	852	42	11·81
Gangetic Plain and Chutia-Nagpur	5,564	625	26	12·58
Upper Sub-Himalayan	15,263	657	25	9·37
North-Western Frontier, Indus Valley, and North-Western Rajputana.	16,051	957	32	10·09
South-Eastern Rajputana, Central India, and Gujarat.	10,994	1,024	37	11·46
Deccan	14,468	602	26	6·22
Western Coast	2,021	842	33	14·84
Southern India	6,436	655	32	10·25
Hill Stations	20,936	945	35	15·19

In eight of the 12 groups the daily sick-rate was higher than that for the whole Native Army, and in six the mortality was greater. The highest mortality was recorded by the Hill Stations group, viz., 15·19, of which pneumonia and other respiratory diseases contributed 5·35. In 1900 this group returned a death-rate of 15·39.

Of the large stations with a strength of over 1,000, the following recorded the highest death-rates :—Bombay 21·36, Meean Meer 20·75, Dera Ismail Khan 16·09, Edwardesabad 14·30, Abbottabad 13·28, and Bakloh 12·94. In the first four stations pneumonia was the chief cause of death and in the other two tubercle of the lungs.

III.—GENERAL POPULATION.

The year 1901 was hotter and slightly drier than usual, and the rainfall was scanty and unevenly distributed. Actual famine was present only in Gujarat and the Deccan, and there was an improvement in the health of the general population as compared with the previous year.

The third general census of India was taken on the 1st of March in the year under notice, the result being an increase of 4·4 per cent. in British India over the population of 1891, and a corresponding decrease in Native States. Registration of vital statistics is improving, though improvement is by no means uniform, and the statistics must still be regarded as possessing only comparative value. In 1901 the birth-rates of the several provinces varied between 41·35 per 1,000 of population in the United Provinces of Agra and Oudh and 18·83 in Coorg, and the death-rates between 37·12 in Bombay Presidency and 19·16 in the North-West Frontier province. Of the chief diseases cholera showed a remarkable abatement, and the deaths fell from 804,378 in 1900 to 271,210. No province was quite free from the disease, but in all the provinces except Madras and Coorg the mortality was lower than in the previous year. The highest ratios under this head were 2·2 in Madras, 1·48 in Bengal, 1·42 in Assam, and 1·13 in the United Provinces. The mortality from small-pox was about the same as in 1900, the deaths numbering nearly 90,000. The fever mortality was 18 per cent. below that recorded in 1900, and accounted for 63·5 per cent. of the total deaths. Dysentery and diarrhœa were much diminished, the deaths having fallen from 525,187 to 248,287. There was an increase under plague of over 67 per cent. For the whole of India the plague deaths in 1901 aggregated 234,672 and of these more than half (128,259) occurred in Bombay, Bengal coming next with 78,629 fatal cases.

The deaths from the chief diseases and from all causes in the several provinces were as follows :—

PROVINCES.	CHOLERA.		SMALL-POX.		FEVERS.		DYSENTERY AND DIARRHŒA.		DEATHS FROM ALL CAUSES.			
	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.		
										1901.	1900.*	
Bengal	110,753	1·48	37,680	0·50	1,617,019	21·72	59,643	0·80	2,310,424	31·04	36·63	[34·98]
United Provinces of Agra and Oudh.	53,995	1·13	981	0·02	1,118,977	23·46	27,172	0·57	1,445,035	30·30	31·13	[30·61]
Punjab	180	0·01	6,154	0·31	508,035	25·26	14,722	0·73	726,611	36·13	47·69	[48·74]
North-Western Frontier Province.	117	0·06	955	0·47	29,108	14·23	380	0·19	39,208	19·16	30·0	[25·46]
Central Provinces ..	49	0·01	6,081	0·63	138,707	14·28	11,487	1·18	227,853	23·46	57·82	[62·68]
Lower Burma ..	3,552	0·64	2,468	0·44	47,990	8·65	8,151	1·47	120,565	21·74	27·51	[22·01]
Upper Burma (13 towns).	1	—	7	0·02	2,686	8·93	136	0·45	10,010	33·27	21·80	[34·00]
Coorg	58	0·32	449	2·48	5,182	28·69	218	1·20	6,590	36·49	36·42	[34·89]
Assam	7,468	1·42	3,274	0·62	83,696	15·86	11,576	2·19	146,939	27·85	30·64	[30·63]
Madras	81,370	2·2	26,202	0·72	294,854	7·90	42,084	1·13	796,140	21·3	23·4	[20·65]
Bombay	13,600	0·74	5,340	0·29	291,951	15·80	60,198	3·26	686,134	37·12	70·07	[71·35]
Berar	17	—	190	0·07	37,848	13·93	11,853	4·36	75,080	27·6	82·7	[86·85]
Ajmer Merwara ..	50	0·10	4	0·01	13,089	27·45	667	1·40	15,798	33·13	119·97	[136·40]
Total ..	271,210	1·21	89,785	0·40	4,189,142	18·73	248,287	1·11	6,606,387	29·46	38·6	[37·20]

* The figures within brackets show the death-rate for 1900 if calculated on the 1901 census returns.

Bengal. The health of Bengal during 1901 improved, the birth-rate having increased since the previous year by 1·63, and the death-rate decreased by 3·94 per 1,000, but they still compare unfavourably with the quinquennial average. The scanty and irregular rainfall affected the agricultural outturn and these conditions are to some extent reflected in the vital statistics. The statistical data in the provincial review are based on the census of

1901. The number of births registered in the province rose from 2,749,582 or 36·94 per 1,000 of population in 1900 to 2,870,806 or 38·68, the latter being made up of district rates varying from 44·69 in Muzaffarpur to 10·76 in Calcutta. 18 other districts had rates exceeding 40 per 1,000 while in 17 districts, in many of which the prices of food grains during 1900 were very high, the birth-rate was lower than in the previous year. In all the districts but four the birth-rate was over 30 per 1,000. The divisional statistics for 1901 are satisfactory, the birth-rate being higher and the mortality lower in every division of the province except Burdwan and Orissa. The provincial birth-rate of 38·57 is calculated from the returns of 719 registering circles of which 157 are urban and 562 rural; the former give a ratio of 22·74, the latter of 39·39 per 1,000. The birth-rate is thus considerably lower in the towns than in the rural areas as is usually the case. 10 towns recorded a birth-rate of over 40 per 1,000, the highest being 54·77 at Jamalpur, and 71 below 25 per 1,000, the lowest being Jhalokati. As a result of the general unhealthiness and the high range of prices during 1900, only 93 rural areas returned a birth-rate of over 45 per 1,000, against 107 and 247 during the two previous years.

The total number of deaths registered during the year under review was 2,310,424, or 31·04 per 1,000, as compared with 2,603,736, or 34·98 in 1900. There was thus an excess of births over deaths of 7·53 per 1,000 of population. Twenty-three towns had a death-rate above 44 per 1,000, but only 45 rural areas exceeded this figure, against 116 in 1900. The district rates ranged from 56·79 in Patna to 20·21 in Sonthal Parganas. In both urban and rural areas there was a notably decreased mortality, the ratio in the former falling from 41·14 per 1,000 to 37·12, and in the latter from 34·66 to 30·72.

From all the principal diseases, except small-pox and plague, the mortality was lower than in 1900. The severe epidemic of small-pox which lasted throughout the year was more than counterbalanced by the comparative absence of cholera. Of the four great natural divisions of the province (Bengal, Behar, Chota Nagpur and Orissa), it was only in the last-named that the incidence of the chief diseases was more severe.

Although but one district enjoyed complete immunity from cholera during the year, the disease claimed only 110,753 victims against 345,878 during the previous year, the corresponding ratios being 1·48 and 4·64 per 1,000 respectively. Except in five districts the mortality from cholera diminished; 18,806 villages were attacked, against 33,142 in 1900, and the disease assumed an epidemic form in 43 areas against 228. This marked subsidence is attributed to sufficiency of the people's food supply, and the necessity they were under of obtaining pure water for domestic purposes from rivers, instead of from their often unclean wells which the deficiency of rainfall had left dry. As measures of prevention, disinfection of wells was carried on in 12 districts with good results, and the anti-cholera inoculations, though less numerous, were effective. At Goalundo, *e.g.*, among coolies exposed to the disease, only 1·2 per cent. of those inoculated were affected and none died, while of those not inoculated 8·36 per cent. took the disease, of whom 50 per cent. died.

The mortality from small-pox was greater than it has ever been since 1877, the number of deaths rising from 20,620 or ·27 per 1,000 in 1900 to 37,680 or ·50. The disease was present in all the districts, and in 37 out of the 46 the mortality therefrom was higher than during the previous year. Cuttack (3·51), Midnapore (2·49), and Calcutta (2·47), recorded the highest death-rates, but in five other districts, including Balasore and Puri, a rate of over 1 per 1,000 was recorded. The disease was thus virulent throughout the Orissa Division. The death-rate from small-pox was higher in towns than in rural areas, being in the former 1·09 per 1,000, and in the latter ·47.

Nearly 70 per cent. of the total number of deaths were recorded under the head of fever. Prevalent in every district this disease caused 1,617,019 deaths, against 1,703,804 in 1900, the corresponding ratios being 21·72 and 22·89 per 1,000. The mortality was higher in 16 districts and lower in the rest, and the fever death-rates ranged from 35·27 in Dinajpur to 7·44 in Calcutta. In spite of the virulence of the disease there was again no increase in the sale of quinine, but on the contrary a slight decrease. The type of fever prevalent in all but 12 districts of the Province was chiefly malarial, and the cause assigned is the excessive humidity of the soil, both in the Terai districts and the low-lying lands stretching down to the sea-board.

Dysentery and diarrhœa were less prevalent than in the preceding year; 59,643 persons succumbed, against 64,664 in 1900, the corresponding ratios being ·80

and ·91. The incidence of these diseases was more severe in 10 only out of the 46 districts. Puri (5·56 per 1,000), Patna (5·06) and Howrah (4·54) recorded the highest death-rates, while Darjeeling, which in 1900 headed the list, came fourth. For three years the diseases have prevailed with the greatest intensity in the same 16 districts, the above four and Calcutta, Cuttack, Balasore, Saran, Hooghly, Dacca, Ranchi, Midnapore, 24-Parganas, Burdwan, Jalpaiguri, and Darbhanga.

Plague was increasingly rife throughout the province during the year under review, cases having been reported from every division. In six of the divisions, however, the cases were chiefly sporadic, the brunt of the disease being borne by the Patna division, where 52,998 out of the 56,190 deaths which occurred outside the towns were recorded. As in 1900, Patna, Saran and Gaya were the districts which suffered most severely. The total number of plague deaths for the whole province was 78,629, more than double the number of the previous year (38,412). Of the three methods of prevention, evacuation of houses was readily resorted to in country districts, disinfection was usually regarded with suspicion, but was carried out in some of the larger towns with good results, while inoculation was also attempted and seems to have been attended with a considerable measure of success in Gaya town.

In the municipality of Calcutta the birth-rate again fell, and for 1901 stood at 10·76 per 1,000, being much lower than in mufassal towns where it was 26·34. The registered deaths numbered 32,456 or 38·28 per 1,000 of population, against 36,709 in the previous year. There was increased mortality from small-pox (2,097 deaths, against 1,010 in 1900), but less from plague (7,883 deaths, against 8,278), and cholera (1,720 deaths, against 2,754). Infant mortality was especially heavy in Calcutta, the ratio being 48 per cent. of births.

United Provinces of Agra and Oudh

The year was a very healthy one in the United Provinces of Agra and Oudh; the birth-rate was higher than the quinquennial average, and, except in the district of Naini Tal and in certain of the towns, higher also than the death-rate. The statistical data of the year under report are based upon the census of 1901, according to which the population of the United Provinces stands at 47,691,782, the increase during the last decade being 786,991, and the yearly rate of increase 1·6 per 1,000. During the year 1,972,131 births were registered, being equal to 41·35 per 1,000, against 1,892,169 or 40·34 in 1900. Of the total 48 districts 29 exceeded and 19 fell short of the provincial average birth-rate, which was composed of rates varying from 51·28 in Hardoi to 27·81 in Dehra Dun. Ten other districts, including Moradabad (50·13), Budaun (49·93), and Shahjahanpur (48·09), returned rates of over 45, and 7 of below 35 per 1,000. The birth-rate in municipalities was 40·28 against 41·26 in the previous year, and was made up of extremes ranging from 57·90 in Pihani to 16·67 in Mussoorie.

The number of deaths recorded was 1,445,035 or 30·30 per 1,000 of population, against 1,460,139 or 31·13 in 1900. Of the districts, Benares showed the highest death-rate, viz., 40·35, while Farrukhabad, Hardoi, Bareilly, and Lucknow also exceeded 38. Gorakhpur (19·69) and four other districts returned rates of less than 23 per 1000. In municipalities the death-rate again rose from 42·75 in 1900 to 43·29, the mortality being highest in Brindaban (76·11) and Benares (74·66), both pilgrim resorts, and of 104 municipalities 35 recorded more deaths than births. Registration was again tested by the local authorities, and the result disclosed omissions of 2·40 per cent. on 317,086 births and of 1·99 per cent. on 241,983 deaths. The percentages of omissions discovered by the vaccination staff were ·46 and ·27 of births and deaths respectively. Infantile mortality has on the whole been rising during the last decade, and in the year under review stood at 232·7 per 1,000 infants born. The seasonal incidence of the total mortality closely followed that of the fever mortality, being highest in October and lowest in February.

Cholera was less prevalent than in the preceding year. The total number of deaths recorded was 53,995 or 1·13 per 1,000 against 84,960 or 1·81 in 1900. Of the districts, Hardoi showed the highest ratio, 5·33, while for the town of Sahatwar the cholera death-rate was 28·93. The heaviest mortality occurred in September and October. Treatment of the wells with permanganate of potash and the appointment of men of either caste to draw water for all from uninfected wells proved of benefit as measures of prevention.

Only 981 deaths from small-pox occurred, and the death-rate from this disease fell from 0·03 in 1900, which was itself the lowest on record, to 0·02. No high rates were anywhere recorded. The Sanitary Commissioner, Major J. Chaytor-White, I.M.S.,

observes: "the beneficial effects of vaccination were assuredly never more eloquently proved, and in this respect we can, I venture to think, compare favourably with many European communities."

The mortality from fever was slightly heavier than in the previous year, 1,118,977 deaths being returned under this head against 1,106,030 in 1900, the ratios being 23·46 and 23·58 respectively. Naini Tal (34·83), Bulandshahr (34·51), Budaun (34·41), Saharanpur (33·64), and Farrukhabad (33·52) were the districts which showed the highest fever death-rates. Even allowing for inaccuracies of the unskilled reporting agency, according to which nearly 80 per cent. of the total deaths in the province are set down to fever, the mortality from malarial disease, especially in rural districts, is still deplorable; in this connection it is satisfactory to note that nearly five times as many packets of quinine were sold in 1901 as in the previous year, the increased sales being almost entirely conducted by the post offices, and the price having been reduced.

Deaths from dysentery and diarrhœa fell from 30,652 in 1900 to 27,172, and the death-rate from ·65 to ·57. Garhwal, as usual, recorded the highest district death-rate, 7·06, and other high rates were 3·32 in Almora and 3·07 in Benares.

Plague, which in the previous year occasioned only 135 deaths, in 1901 established itself in the United Provinces. Altogether 10,190 cases and 9,778 deaths were reported, giving the heavy mortality of 95 per cent. The disease was practically confined to four districts, though sporadic cases occurred in seven others. In Ballia 5,278 deaths were recorded during the year, in Benares 3,064, in Jaunpur 712, and in Allahabad 661. Raniganj, the town in Ballia where the first outbreak occurred, is believed to have taken the disease from the infected district of Saran in Bengal, with which it has commercial relations. In order to combat the progress of the plague the Sanitary Commissioner observes that the policy has been adopted of enlisting the help of the affected community, of working with and not against the people, who as a rule show readiness in evacuating their houses and applying for disinfection.

Punjab.

There was considerable improvement in the health of the Punjab in the year under review; small-pox was less fatal, cholera was practically absent from the province, and there was a great diminution in the fever mortality. The vital statistics are based upon the census of 1901, which gives a total population for the province as at present constituted of 20,108,690. The total number of births registered was 712,533 against 843,970 in 1900, the corresponding ratios being 35·4 and 41 per 1,000. This decrease was largely due to the sickly autumn season of 1900. The provincial rate was made up of district rates ranging from 44·1 in Sialkot to 15·8 in Simla. As compared with the mean average for the previous five years the decrease in the birth-rate was most considerable in Ferozepore and Umballa, the deficit amounting to 16·7 and 14·9 per 1,000 respectively. The provincial birth-rate was lower than the death-rate by 0·7 per 1,000, and this excess of deaths over births was most marked in the Delhi Division, and in the districts of Ferozepore and Ludhiána.

From all causes 726,611 deaths were recorded, giving a death-rate of 36·1, against 980,211 or 47·69 in 1900. Thus, while the death-rate was exceeded only in Bombay Presidency, a fall of 10 per 1,000 from the figures of the preceding year was registered in the Punjab. Ludhiana (52·2), Karnal (51·5), and Ferozepore (48·8) were the unhealthiest districts in the province, while seven others exhibited high rates exceeding 40 per 1,000. In several cases, however, these rates, though high, were an improvement on the previous year's record, *e.g.*, in Hissar (43·7) the ratio was 52·0 less than in 1900. In the Multan and Rawalpindi divisions the mortality was lowest, the rates for the most part varying from 20 to 25 per 1,000. The death-rate was heavier among females than males, and infant mortality continued to rule high.

The province enjoyed almost complete immunity from cholera. Only 180 deaths, for the most part in the districts of Umballa and Karnal, were recorded from this disease, of which, in 1900, there were 28,260 fatal cases.

Small-pox was less prevalent, 6,154 deaths being returned under this head, giving a rate of 0·31, against 10,425 and a rate of 0·51 in the previous year. More than half the mortality occurred among children under ten years of age. The disease was most fatal in the districts of Montgomery and Jhang, where there were 1,082 and 1,298 deaths respectively, while in the district of Kangra only 20 deaths took place. This contrast

shows well the efficacy of vaccination, for in Kangra the number successfully vaccinated during 1900–1901 was 70 per 1,000, while in Jhang and Montgomery the ratios were only 26 and 20 per 1,000.

There was a marked diminution of fever mortality in 1901, the deaths being less numerous than in the previous year by 141,594. In spite of this the disease accounted for a death-rate of 25·3 per 1,000, and for 508,035 deaths or 70 per cent. of the total mortality of the year. The decrease took place in almost every district, and was most considerable in the three districts with the highest rates, viz., Hissar, Ferozepore, and Karnal, where the fever death-rate fell to 37·0, 39·9, and 39·6, against 70, 64, and 54 in 1900. The high mortality, especially in these districts, was largely due to the after-effects of the outbreak of the previous autumn. In Rohtak (37·4) and Ludhiana (34·4) the mortality was also in excess of the average of the province.

The mortality from dysentery and diarrhœa followed the fever mortality in its falling away from the dimensions of the previous year. 14,722 deaths were recorded giving a rate of 0·73. The decrease, amounting in all to 11,191 was general, and with few exceptions, was distributed throughout all the districts. The highest death-rates were reported from Simla (1·66), Umballa (1·51), Delhi (1·43), and Gurdaspur (1·32).

Plague effected a lodgment in the Punjab during the year under review, the mortality leaping from a total of 495 for 1900 to 14,959 at the lowest estimate for 1901. It appears, however, from returns compiled in the Plague Department that at least 17,000 deaths should have been recorded under this head. A marked increase took place in the three districts, Jullundur, Hoshiarpur, and Gurdaspur, which were plague-stricken in 1900, the number of deaths for the two years being 3,857 and 417, 2,308 and 43, 4,325 and 35, respectively. Seven fresh districts were infected, but of these only in Sialkot, adjoining Gurdaspur, was the mortality considerable; 3,695 cases terminating fatally. The disease was especially virulent towards the end of the year, 61 per cent. of the mortality being registered in November and December.

North-West Frontier Province.

The five districts comprising the North-West Frontier province usually enjoy good health, and the year 1901 was no exception. Harvests were generally good and the absence of famine, of plague, and to any considerable extent of cholera, kept the death-rate below the birth-rate by 10·3 per 1,000. There was a decrease in the number of births registered, viz., 60,413, against 62,084 in 1900, the rates being 29·5 and 30·3 respectively. This result must be set to the account of the unhealthiness of the previous year, and its influence upon fecundity. The decrease was most marked in the Pesháwar, Kohat, and Bannu districts.

A diminished mortality was also recorded in the year under review, 39,208 deaths or 19·2 per 1,000 being registered, against 52,103 or 30·0 in 1900. This rate was the smallest returned by any province of British India; it was composed of extremes varying from 25·6 in Dera Ismail Khan to 16·6 in Hazára. The mean death-rate in the 10 municipalities was 18·28.

Cholera only claimed 117 victims, against 3,275 in 1900, and was practically confined to the Pesháwar district. Treatment of the wells with permanganate of potash is reported to have been attended with excellent results.

There were 955 deaths from small-pox, 772 being children of 10 years or under. The death-rate from this cause was 0·47. The figures for the previous year were 1,390 and 0·68.

The fever mortality also diminished, although 74 per cent. of the total mortality was returned under this head. 29,108 deaths occurred, giving a rate of 14·23 against 17·35 in 1900.

From dysentery and diarrhœa 380 persons died, the resulting rate being 0·19. Of the total number of deaths 167 took place in Dera Ismail Khan district.

The province was free from plague throughout the year.

Central Provinces.

As compared with the previous year an improvement was manifested in the health of the Central Provinces, but 1900 was, with the exception of the famine year 1897, the worst on record as regards public health. The birth-rate still compares unfavourably with that of the other provinces and indicates a low vital condition of the people. The statistics of the year under review are based upon the census of 1901, which gave a total population of the British districts under registration of 8,673,030—the falling off during the last decade being accounted for by successive years of famine and plague, and by successive epidemics of cholera and small-pox.

A total of 279,998 births was registered, against 335,436 or 31·87 per 1,000 in 1900. The resulting birth-rate of 28·83 was the lowest recorded during the last two decades, save in 1897, when it sank to 26·83. In every district during 1901 it was below the decennial mean. The births exceeded the deaths in all districts but two, Bhandara and Chanda, where the birth-rates were remarkably low, viz., 21·35 and 20·60 respectively.

The deaths during the year numbered 227,853 or 23·46 per 1,000, against the terrible mortality of 1900, when 608,691 deaths occurred and the rate rose to 57·82. The provincial death-rate was exceeded in 11 districts, the mortality being highest in Jubbulpore (29·4), Wardha (29·3), Burhanpur (29·1), and Narsinghpur (28·9). Infantile mortality, calculated on the number of births during the year, was 246·41 for males and 224·63 for females.

The epidemic of cholera which raged in 1900 and carried off 75,112 people completely subsided. Only 49 deaths were returned under this head and the death-rate was infinitesimal (0·01).

The epidemic of small-pox continued from the previous year, but with less severity. 6,081 deaths were recorded against 8,021 in 1900, the corresponding ratios being 0·63 and 0·76. Of the victims, 4,591 were children under 10 years of age. Every district was affected, Nagpur with 1,851 deaths and a rate of 2·46, and Damoh with 682 deaths and a rate of 2·39 being the chief sufferers. Only one other district, Wardha (1·52), recorded a death-rate of over 1 per 1,000.

The bulk of the mortality was returned under the heading of fever. From this cause, 138,707 deaths were reported against 303,370 in 1900, the resulting death-rates being 14·28 and 28·82. The highest rate was recorded in Nimar, 23·9, and 12 districts in all exceeded the provincial rate. There was a slight increase in the number of packets of quinine sold, and towards the end of the year the price of the drug was reduced from 3 to 2 pies per five-grain powder.

A similar marked diminution of mortality from dysentery and diarrhœa was registered, the number of deaths falling from 58,474 to 11,487, and the death-rate from 5·55 to 1·18. Bhandara (0·14) again returned the lowest rate from this cause, and Wardha (2·77) the highest.

No cases of indigenous plague occurred in the year under review, and only 10 imported cases were noted. At the close of the year only two inspecting stations were being maintained, viz., Burhanpur and Wardha.

Burma.

There was some slight improvement in the checking of birth and death registers in Burma during the year. The total population of the province according to the census of 1901 was 9,252,175, but since registers of births are not kept in the rural districts of Upper Burma the available vital statistics are calculated on a registered population of 5,546,265. An increase of 1,085,238 has occurred since the census of 1891, on which the statistical data of previous reports have been based. This large difference vitiates any comparison of the figures of the year under review with those of the previous year.

The total number of births registered in Lower Burma rose from 171,183 in 1900 to 177,865. The birth-rate fell from 38·37 to 32·07. This anomaly is explained by the caveat entered above, since it is due to the new census enumeration being taken as the basis of calculation. Further, this rate (32·07), the Sanitary Commissioner remarks, "is scarcely consistent with the probabilities," falling short by over 6 per 1,000. Birth-rates recorded in districts ranged from 40·68 in Henzada to 12·70 in Rangoon. Of the towns the lowest rates were those of the seaports Rangoon 12·70, Akyab 18·61, Moulmein 21·13, owing to the disparity of the sexes and the large floating population. From the 13 towns under registration in Upper Burma a total of 11,334 births and a rate of 37·66 were returned. After allowance is made for the reduced census population of these towns, the figures indicate some improvement in registration.

The mortality in Lower Burma was slightly less: 120,565 deaths were registered against 122,714 in 1900. The calculated rates for the two years, 21·74 and 27·51, do not admit of comparison (as explained above). The incidence of mortality in urban and rural districts was 29·99 and 20·62 respectively. Four towns recorded rates of over 35 per 1,000 and five of under 21, the figures in the one case being attributable to epidemic diseases and in the other case to defective registration. The rate of infantile mortality returned for Lower Burma was 206·6 per 1,000 of male births and 168·6 per 1,000 of female births. In the towns of Upper Burma 10,010 deaths were recorded, giving a rate of 33·27. Mandalay returned the highest rate (35·80).

In Lower Burma the mortality from cholera increased slightly in the year under review: 3,552 deaths, or 0·64 per 1,000, occurred, against 3,440 in 1900. Prome (1·50), Thóngwa (1·28), Myaungmya (1·23), and Amherst (1·15) were the districts which chiefly suffered. Only one cholera death was reported from the towns of Upper Burma.

Small-pox accounted for 2,468 deaths in Lower Burma, against 3,014 in 1900. About 44 per cent. of the victims were children of 10 or under. This disease, like cholera, was practically non-existent in the towns of Upper Burma, only seven deaths being recorded under this head.

The fever mortality in Lower Burma was slightly less, 47,990 deaths being registered against 49,888. The resulting rate 8·65 is lower than that of any Indian province except Madras. The sale of quinine has fallen from 2,976 to 2,814 packets. In Upper Burma the mortality from fever increased very slightly, the figures for the year being 2,686 or 8·93. Among the districts of Lower Burma, Sandoway (14·86), Akyab (13·83), Mergui (12·50), returned the highest fever death-rates; Mandalay (10·82) and Kyauksè (10·15) exhibited the heaviest rates among the towns of Upper Burma.

Dysentery and diarrhœa caused 8,151 deaths and a rate of 1·47 in Lower Burma and 136 or ·45 in Upper Burma. The highest mortality was recorded in the towns of Allanmyo (4·81), Rangoon (4·55), Toungoo (4·17), Kyaukpyu (4·13), and Bassein (3·95).

The whole province enjoyed complete immunity from indigenous plague throughout the year, and only five imported cases were observed, three of which terminated fatally.

Assam.

The general health of the people of Assam was above the average of the provinces of British India during 1901. The statistical data for this review are based upon the census of 1901. Registration in Assam is not everywhere compulsory, and even where compulsory, is not always complete although checked by the police and the vaccination staff. For the general provincial ratios the figures for the Surma and Brahmaputra valleys are taken, viz., 5,275,706. The total number of births registered was 179,289 or 33·98 per 1,000, against 184,427 or 34·96 in 1900. The highest rate was again recorded by the Goalpara district 44·25, followed by Sylhet 36·49 and Cachar 35·38, these being the only three instances in which the provincial rate was exceeded.

There was a considerably diminished mortality during the year under review. In all 146,939 deaths occurred, against 161,631 in 1900, the corresponding ratios being 27·85 and 30·64 per 1,000. This indicates an improvement in the public health as compared not only with the two previous years but also with the average for the 15 years from 1884–1898, when the figures were 152,787 and 29·06 respectively. Darrang (35·19) and Goalpara (34·09) returned the highest death-rates among districts. The death-rates in the towns exhibited large variation, but save in the case of Sylhet (40·74) the importance of the high figures is minimised by the small numbers from which the ratios are calculated. The average of infant mortality for the province was 195·59 per 1,000 of registered births.

Cholera assumed much smaller proportions, only 7,468 deaths being recorded against 23,761 in 1900, the respective rates being 1·42 and 4·51. A succession of small epidemics in Kamrup and Cachar caused the highest death-rates of 2·88 and 2·84. Nowgong, which in 1900 suffered severely from the visitation of this disease, was almost completely free, the death-rate having fallen from 24·95 to 0·13. Among the coolies working in the tea-gardens the mortality from cholera was 2·17 per 1,000; only 58 out of 22,242 coolie immigrants died of the disease while being conveyed to their place of employment.

The incidence of small-pox was heavier than in the preceding year; 3,274 deaths occurred against 975 in 1900, giving rates of ·62 and ·18. Sylhet exhibited the heaviest mortality, 1·13 per 1,000, the several outbreaks in this district resulting in 2,540 deaths.

An increase in the number of deaths from fever brought the death-rate from this cause up to the level of the average for the 15 years from 1884–98, viz., 15·90. In all 83,696 deaths occurred, giving a rate of 15·86. Thus practically no improvement in this respect has taken place during the last two decades, and in the long run about 16 per 1,000 of the population each year die from the effects of malaria. The districts of Goalpara (29·70) and Darrang (23·89), as in the previous year, recorded the highest death-rates. The sale of quinine made but slow progress, and it is observed that "the drug has yet to gain the confidence of the people." Included in the total of 83,696 fever deaths are 5,856 deaths from kalá-ázár. This disease has been the scourge of the province for many years, as may be seen from the instances of Nowgong, Darrang and Kamrup. These three districts have specially suffered from the malady, and the

first and third have alone of the districts decreasing population during the last decade. It is satisfactory to note that the mortality from kalá-ázár has fallen 70 per cent. since 1897. The disease has been found to be more prevalent than was supposed in Sylhet, but as a set-off has practically disappeared from Goalpara, and the mortality during 1901 was heavy only in Darrang (2,446 deaths) and Nowgong (2,346 deaths).

From dysentery and diarrhœa 11,576 deaths were reported, against 14,996 in 1900, the provincial death-rates being 2·19 and 2·84 respectively. The rates in the various districts vary remarkably, ranging from 0·29 in Goalpara to 4·72 in Lakhimpur.

Madras.

In Madras the climatic conditions of the year were on the whole unfavourable to public health and the prices of food grains ruled high. The population of the Presidency, according to the census of 1901, was 38,623,666, showing an increase during the last decade of 2,572,646 ; but the population under registration during the year was 37,315,611. Registration in 1901 was compulsory in all municipal areas, and also, under the provisions of Madras Act III of 1899, in 441 villages against 400 in the previous year. The nominal birth-rate (25·1) and death-rate (21·3) for the province continue to be inaccurate. The Government of Madras observe: "There can be little doubt that the chief cause of the imperfection of the statistics is the failure to register the births and deaths of infants who die in the first few months of life."

There was a decrease of over 100,000 in the total number of births registered in 1901 as compared with the previous year, the figures being 935,749 and 1,049,199 for the two years respectively. This result is attributed partly to the influence of the high price of food upon fecundity, but mainly to the unfavourable character of the year 1900. The corresponding birth-rates are returned as 25·1 and 31·8 ; but the figure for the year under review is quite inaccurate, as the Government of Madras remark, "the actual birth-rate is certainly not less than 40 per 1,000," instead of 25·1. This is borne out by the returns from municipal towns where registration though defective is at least compulsory, the birth-rate for such areas being 32·6 per 1,000. Of districts, Madura (16·1), North Arcot (19·1), and Ganjam (20·5) recorded the lowest rates. The low rates of Madura and Ganjam, however, are to some extent fictitious, since, with regard to the large zemindari tracts in both districts, while the census population has been included in the calculations the actual births have not, statistics not being available. Among the other districts the most notable diminution of birth-rates occurred in Chingleput with a decrease of 13·6, North Arcot 9·8, Madras 9·0, Kistna 8·6, and Kurnool 7·5. In municipal areas the birth-rate, as stated above, was 32·6, which indicates, after allowance has been made for the more accurate registration in towns, that the pressure of high prices was chiefly felt in rural tracts.

The mortality in 1901 was higher than that of the previous year by 25,281, the total number of deaths registered being 796,140. The nominal death-rate was 21·3, which, the Government of Madras observe, "is nearly as inaccurate as the birth-rate." The returns for municipal towns showed a death-rate of 35·4 per 1,000. The highest rate was 55·5 recorded by Madras City. In the other districts the ratios ranged from 30·1 in Chingleput to 14·8 in Ganjam and 10·9 in Madura. Among municipalities the death-rate was considerably above normal in Bellary (48·1), Berhampur (40·5), and Chingleput (38·4). As regards infantile mortality, the provincial death-rate was returned as 166·2 per 1,000 of the registered births. This figure is far below the rates returned by the other provinces, and, when contrasted with the rates for municipalities, 237·3 per 1,000, and for Madras City, 295 per 1,000, is clearly defective. Of the rate in Madras City the Government state that "it does not err on the side of excess."

Of the chief diseases cholera accounted for a largely increased mortality, 81,370 persons having fallen victims to the disease as compared with 60,662 in 1900. The death-rate rose accordingly from 1·8 to 2·2, which is much higher than the figure for any other province. The districts which chiefly suffered were Salem (5·1), Anantapur (4·5), Cuddapah (4·2), and North Arcot (4·1). Among the towns with the greatest mortality from this cause were Madras 1,161 deaths or 2·4 per 1,000, Calicut 819 or 10·6, Salem 510 or 7·2, and Trichinopoly 306 or 2·9 ; but Vániyambádi with 333 fatal cases and Arcot with 160 returned the highest cholera death-rates, viz., 27·7 and 14·9.

Small-pox was somewhat less prevalent than in 1900, the total number of deaths registered under this head in the two years being 26,202 and 27,692 respectively, the resulting death-rates being 0·7 and 0·8. The rate of incidence in municipal towns where vaccination is compulsory was 0·6. Among districts the largest number of deaths occurred in Godavari (2·4) and North Arcot (1·1), and among municipalities in Cochin

(17·8), which lies adjacent to an area under native administration. Striking figures are given by the Sanitary Commissioner, which testify to the efficacy of vaccination in mitigating infant mortality from this disease. Contrasting the conditions at the beginning and at the end of the last decade, in 1891 and 1901 respectively, the infantile mortality from small-pox in rural districts has advanced from 7·3 to 8·6 per 1,000, while in municipal areas (where since 1894 compulsory vaccination has been universal) this same mortality has fallen from 8 to 2·7 per 1,000.

294,854 persons against 288,521 in 1900 were returned as having succumbed to fevers. These were chiefly malarial, though cases of typhoid occurred. The fever death-rate for the Presidency, 7·9, was composed of extremes varying from 18·3 in Madras to 3·6 in Anantapur. Kurnool, the Nilgiris, Nellore, Cuddapah, Vizagapatam, Kistna Ganjam, South Canara, and Godavari also recorded rates of 10 or over. For all these districts the mean fever death-rate of the previous five years was high.

From dysentery and diarrhœa there was an increased mortality, 42,084 deaths being registered against 38,858 in 1900. The rate of incidence for the Presidency was 1·1, whereas for municipal towns it amounted to 5·0. The force of the disease fell especially upon the following districts: Madras (9·7), Chingleput (3·5), South Canara (2·6), Malabar (2·3); towns: Palamcottah (15·5), Tuticorin (10·1), Madras (9·7), Chingleput (9·4).

Plague spread in the province during the year under review, 3,960 cases being reported against 895 in 1900. The total mortality was 3,035 or 76·6 per cent. of cases, giving a death-rate of 0·1. Of the municipalities, Vaniyambadi (769 cases) and Bellary (702) suffered severely. The chief source of infection was Mysore. Surveillance was kept up by the passport system with good results.

Bombay.

In the general health of the Bombay Presidency in 1901 some improvement was manifested on the terrible record of the previous year. The lasting effect of recent plague and famine was visible in the low birth-rate, and in the whole Presidency 220,487 more deaths than births were registered in the year under review. The statistics of the present review are based upon the census of 1901, which gives a total population, exclusive of Europeans and Eurasians, of 18,481,362. In comparing the birth and death rates for 1901 and 1900 there is an even larger decrease than appears from the figures given below, since the ratios for the latter year (1900) are based upon the larger census population of 1891.

The birth-rate in 1901 (25·19) was the lowest recorded during the last decade. In all 465,647 births were registered, against 505,662 in 1900. The lowness of the rate is ascribed to weakness induced by famine; this condition began to take effect upon the birth-rate in April, 1900, reached its climax in March, 1901, and passed off in December, 1901, when the rate again reached the mean of the previous ten years. The district birth-rates ranged from 33·43 in Khandesh to 8·36 in Thar and Parkar, in which district it was probably due to the exodus caused by scarcity. The number of births recorded was less than in the previous year in all but six collectorates. For the most part the birth-rates were higher among the rural than the urban population, especially in the Poona collectorate, where the figures were 29·63 rural and 11·70 urban.

A decrease of nearly one-half in the number of deaths in the Presidency brought down the death-rate from 70·07 in 1900 to 37·12. In all 686,134 deaths were registered, against 1,318,783 in the previous year. Of the five Registration Districts, the Southern, which suffered from plague, cholera, and famine, returned the highest death-rate of 56·77 per 1,000. In the collectorates the rates ranged from 77·78 in the City of Bombay to 13·21 in the Upper Sind Frontier. Belgaum (71·91), Dharwar (71·26), Ahmedabad (52·68), Broach (50·38), Kaira (48·36), and Sátara (43·35) also returned high rates, all having suffered at some period of the year from plague or famine.

Cholera was only severe in Dharwar (6·87), Belgaum (2·87), Bijapur (1·95), and Kanara (1·44), these being the only districts with a rate of above 1 per 1,000. In all there were 13,600 deaths from this cause, contrasted with 163,889 in 1900, the provincial rates being respectively 0·74 and 8·71. Some 60 per cent. of the attacks proved fatal.

A diminished mortality from small-pox was also recorded, the figures for 1901 and 1900 being 5,340 or 0·29 and 9,885 or 0·52. Only two collectorates were free from the disease which was most prevalent in the Southern Registration District; 68·5 per cent. of the victims were children of 10 years of age or under.

Under "fever" 291,951 deaths were registered, against 543,319 in the previous year, the resulting death-rates being 15·80 and 28·87. In the collectorates of Ahmedabad

(43·69), Broach (27·81), Kaira (25·19), Panch Mahals (21·50), and Thar and Parkar (22·25) high rates were recorded, famine being adduced as the predisposing cause.

The number of deaths ascribed to dysentery and diarrhœa fell from 218,243 or 11·59 per 1,000 to 60,198 or 3·26. This decrease was spread over all the collectorates except Dharwar and Kanara. The highest ratio was recorded in Sholapur 8·12, followed by Ahmednagar and Belgaum with 6·68 and 6·24. Since the famine year of 1897 the number of deaths from this cause has increased greatly, but for the year under review the number fell just within the decennial average.

The plague mortality in 1901 was the highest recorded since the first appearance of the disease in 1896, 128,259 deaths having occurred, giving a rate of 6·94, against 33,196 or 1·76 in 1900. The areas chiefly affected were Belgaum with a rate of 34·07, Dharwar 28·65, Sátára 19·26, and the City of Bombay 24·58. The epidemic spread to 1,582 towns and villages, whereas it was confined to 587 in the previous year Of the deaths, 33,803 occurred in Belgaum, 31,877 in Dhárwár, 22,075 in Sátára, and 18,694 in the City of Bombay. No other collectorate returned more than 4,258 (in Poona).

Berar.

The year was an extremely healthy one in the Hyderabad Assigned Districts. The low birth and death rates are believed to be the result of the recent famine. The vital statistics are based upon the census of 1901, which returned a population of 2,717,346. Inspection of registration though less in amount was more effective in 1901, since there was an increase of 2·2 in the percentage of omissions discovered.

The low birth-rate of 30·8 was recorded for the year under review, being the result of 83,762 births, against 89,302 or 31·3 in 1900. This result is attributed to the condition obtaining in 1900, when famine prevailed and few marriages took place. In July, 1901, nine months after the cessation of famine, the birth-rate began to rise, and for the whole year compared favourably with the recorded rates of the Central Provinces, Bombay, and Madras.

The abnormally low death-rate of 27·6 is ascribed to two causes. The province was free from epidemic diseases and many of the aged and weakly had succumbed to privation in the previous year. As was stated in last year's review, 130,599 or more than half of the persons who died during 1900 were either children under five or old people over 60 years of age. The Sanitary Commissioner remarks that to compare in detail the statistics of the exceptionally healthy year under review with the enormous rates, under every head, which characterised the year 1900 would serve no useful purpose.

The province was practically free from cholera, only 17 fatal cases being reported, of which 16 occurred in Akola. The wells were freely treated with permanganate of potash.

Small-pox claimed 190 victims, chiefly from the districts of Wun and Amraoti ; 108 of these were children under 10 years of age.

The mortality from fevers and from dysentery and diarrhœa was greatly reduced. The former caused 37,848 deaths, against 84,017 in 1900, the latter 11,853, against 63,860, the respective death-rates being 13·9 from fevers and 4·4 from dysentery and diarrhœa. Akola, Amraoti, and Wun were the chief sufferers from the former, while all the districts except Wun and Buldana recorded rates above the provincial average from the latter.

Plague was absent throughout the year.

IV.—JAILS.

Sickness and mortality in 1901.

The health of the jail population of India during 1901 was good as compared with the previous year. Fewer admissions into hospital, less overcrowding, and a marked diminution of the death-rate were the features of a year in which "normal conditions were restored in the provinces which had suffered from scarcity in 1900." Sickness, however, was very prevalent, and although the percentage of fatal cases was smaller, the average both of admissions into hospital and of daily sick showed an increase over the two years immediately preceding.

Thus the daily average sick per 1,000 of average strength rose from 32·4 in 1900 to 34·3, the ratio of admissions into hospital from 851 to 882, while the death-rate declined from 33·4 to 25·3. Save in the United Provinces, Punjab, Assam and Coorg, the death-rate everywhere decreased, and notably in Berar, the Central Provinces, Bombay, Bengal and Burma; in Burma it was the lowest on record; for the rest, which in 1900 were the chief sufferers from the ravages of cholera, their improved condition is largely due to the subsidence of this disease. The total number of cholera deaths fell to 106 giving a death-rate of less than 1 per 1,000 of average strength. Omitting Coorg, which has only one jail, the most unhealthy administrations were, in spite of the improvement on the previous year's record, Bombay and Bengal. The most prevalent diseases were ague, dysentery and influenza; the most fatal dysentery, tubercle of the lungs and pneumonia.

The following statement shows the sickness and mortality among all classes of prisoners in the jails and subsidiary jails of the various provinces for 1901, as compared with the previous year:—

Provinces.	1900. Ratio per 1,000 of Average Strength.			1901. Ratio per 1,000 of Average Strength.		
	Admissions.	Daily Sick.	Deaths.	Admissions.	Daily Sick.	Deaths.
Bengal	1,173	39	40·3	1,096	38	27·6
United Provinces of Agra and Oudh.	764	36	22·1	840	40	24·2
Punjab	1,239	38	23·6	1,253	38	26·9
Burma	555	28	21·2	547	26	15·2
Central Provinces	934	30	69·0	867	28	27·5
Assam	817	35	22·8	1,029	42	24·5
Coorg	628	24	54·6	654	35	165·9
Madras	412	23	25·4	476	24	21·7
Bombay	778	25	56·8	964	34	35·0
Berar	943	27	79·9	676	21	24·9
India	851	32	33·4	882	34	25·3

Bengal.

The health statistics of the Bengal jails are satisfactory, and do not call for the unfavourable comment which was passed last year. Although the figures are still high, some improvement is manifested under every head. The admissions into hospital were in the ratio of 1,096 per 1,000 of average strength, as against 1,173 in 1900; the average daily sick-rate fell from 39 to 38, and the death-rate from 40·3 to 27·5. This death-rate is considerably below the decennial average (32·7), and is also below the rate (31) for the general population. Among all classes of prisoners there were 588 deaths,

and of these 533 were convicts. The mortality in the jails is seen to be largely dependent on the poor condition of the prisoners when first admitted, for while among prisoners who had been less than six months in prison the death-rate was 39 per 1,000, it was only 21·7 per 1,000 among those between six months and a year in jail. Cholera sensibly abated, only 17 cases terminating fatally as against 78 in the previous year, and the number of deaths from specified diseases is less in every case than in 1900. The most fatal diseases were dysentery (153) deaths, tubercle of the lungs 78, pneumonia 57. Out of 48 jails there were seven in which the death-rate exceeded 40 per 1,000, the highest being Hooghly 81·4, Barisal 78·9, and Bankipore 74·5. In the last of these (as in others of the seven with excessive mortality) there were severe epidemics of plague and cholera. In two jails there were no deaths, and among the jails returned with the lowest mortality it is satisfactory to find Suri, Bogra, Daltonganj and Faridpur, all of which had shown a very high rate for several years previously.

United Provinces of Agra and Oudh.

The sanitary history of the jails in the United Provinces of Agra and Oudh is marked by a slight change for the worse. The ratio of admissions to hospital has risen from 764 per 1,000 of average strength in 1900 to 840; the average of daily sick from 36 to 40, and the death-rate from 22·1 to 24·2. Increased mortality was recorded from tubercle of the lungs, dysentery and heatstroke, and was also heightened by epidemics of cerebro-spinal fever and cholera. The death-rate, however, compares very favourably with that of the free population (30·30). Of the 55 jails in the province there were no deaths in two, and 36 others kept below the provincial average. The jails with the highest mortality ratios were the district jails of Allahabad (58·5), Moradabad (56), Banda (54), and Lucknow Central Jail (44·9); in the first of these three several outbreaks of cerebro-spinal fever sent up the death-rate from 29·9 to 58·5; in the last there was a severe epidemic of cholera causing 27 deaths, and as an indirect consequence a virulent type of dysentery (24 deaths) owing to prisoners having to be in cholera camp during the rains. This was part of a general epidemic affecting alike Lucknow City, cantonments and the surrounding villages. The notoriously unhealthy jails at Mirzapur and Azamgar recorded the low death-rates of 9·7 and 17·2 respectively. As in the previous year Bara Banki, with a single death from an average daily strength of 414, has a good record, closely followed by Partabgarh with one death from an average strength of 323. Beyond the 32 fatal cases of cholera, dysentery caused 163 deaths against 132 in 1900, tubercle of the lungs 106 against 84, pneumonia 67 against 102. Of the 712 prisoners who died 682 were convicts, their death-rate being 24·7 against 22 in 1900.

Punjab.

The standard of health among the prison population in the Punjab was lower than in 1900. While the average of daily sick remained stationary, the ratio of admissions into hospital per 1,000 of average strength rose from 1,239 to 1,253 and the death-rate from 23·6 to 26·9. The pressure on accommodation continued to be considerable. No cases of cholera or small-pox occurred during the year, and the mortality ratios from tubercle of the lungs, pneumonia and dysentery, though still remaining high, displayed some improvement. Out of 28 jails five reported no deaths, while 12 exceeded the ratio of 30 per 1,000. Of these, however, all but four were small jails (for the most part situated in districts where there was high mortality among the general population), in which the high ratios were largely due to the bad state of the prisoners when first admitted. A similar reason is adduced for the increased mortality at Ferozepur (54·26), Delhi (37), and Umballa (36·34); at Mung Rasul (37·21) an epidemic of cerebro-spinal fever broke out in spite of the good sanitary condition of the jail, baffling all measures of prevention and resulting in 29 deaths. Of specified diseases malarial fever, dysentery and diarrhœa were the most prevalent, pneumonia (with 4·9 deaths per 1,000 of average strength), and dysentery (with 4·8 deaths per 1,000) the most fatal. Nearly one-third of the total 362 deaths resulted from diseases of the lungs in some form, and all but 17 of the victims were convicts.

Burma.

The standard of health among prisoners was higher in Burma than in any other administration. The ratio of admissions into hospital per 1,000 of average strength still further diminished from 555 in 1900 to 547, the average of daily sick from 28 to 26, and the death-rate from 21·2 to 15·2, which is the lowest on record. The accommodation in some few cases was temporarily overstrained, but the pressure was promptly relieved by transfers elsewhere. Of the 181 deaths that occurred during the year all but seven were convicts. In five jails and in the European side of Rangoon jail no deaths occurred.

Paungde (63·49) and Bhamo (51·95) exhibit the highest mortality, but they are small jails, and in the first-named there were four deaths from cholera. This disease was also epidemic at Insein, the second largest jail, where it resulted in 20 cases and 12 deaths. Of diseases malarial fevers and bowel complaints were the most prevalent, tubercle of the lungs with 47 deaths, dysentery with 27 deaths, and cholera with 16 deaths the most fatal. Moulmein maintains its reputation for unhealthiness, the number of admissions to hospital for dysentery and diarrhœa alone being 428 out of a total for the whole province of 1,207.

Central Provinces.

The vital statistics of the jails in the Central Provinces betoken a decided improvement in the health of the prisoners and more especially in the mortality ratios. While the rates of admission to hospital and the average of daily sick per 1,000 have fallen from 934 and 30 in 1900 to 867 and 28 respectively, the death-rate has dropped from 69 to 27·5. This is the more satisfactory because the admissions, the Inspector General states, "included a large proportion of persons broken in health and habits by the recent famine." There was but little overcrowding, and relief was found in utilizing worksheds as sleeping-places. In 3 of the 19 jails there were no deaths; of the 6 jails noted as exceptions to the low death-rate generally prevailing, Bhandara with 67·58, Mandla with 60, Jubbulpore with 49·68 stand highest, but in no case did the actual number of deaths exceed six save at Jubbulpore (54), Nagpur (14), and Raipur (15). Of the 132 fatal cases all but six were convicts. No deaths occurred from small-pox, remittent fever, or cholera, but in the matter of bowel complaints the prisoners compare unfavourably with the free population of the Central Provinces. Cerebro-spinal fever, which in 1900 produced 22 cases, all but one of which terminated fatally, was confined to two jails in the year under review.

Assam.

The health of the prisoners in Assam was on the whole good. The ratio of admissions into hospital per 1,000 of average strength rose from 817 in 1900 to 1,029, the average of daily sick from 35 to 42, and the death-rate from 22·8 to 24·5. There was rather more sickness than in the previous year but really less mortality resulting therefrom, since the enhanced death-rate was the result of 4 deaths not due to disease. The marked improvement in the health of the prisoners consequent upon the partial discontinuance of extra-mural work in 1900 is thus maintained. In only three of the 24 jails was the average strength over 100, viz., Sylhet, Tezpur, and Gauhati, and these three contributed 32 out of the 40 deaths, their rates being 32·98, 31·48, and 29·99 respectively. In 16 jails no deaths took place.

Madras.

Madras was one of the healthiest provinces, being surpassed only by Burma. The ratio per 1,000 of admissions into hospital rose indeed from 412 to 476, and the average of daily sick from 23 to 24, but the death-rate fell from 25·4 to 21·7. This in view of the congestion of the prison population, the continuance of scarcity and the consequent impoverished condition of many admitted to jail is satisfactory. Cholera continued prevalent both in an epidemic and sporadic form; the disease made its appearance in three central and five district jails, resulting in 34 deaths. 21 of these occurred at Madura District Jail where the epidemic was specially virulent. In every case complete or partial evacuation was resorted to and attended with the best results. Of prisons which exceeded the provincial death-rate, the case of Madura (84·61) has already been noted; Trichinopoly Central Jail returned 30 cases and 6 deaths from tubercle of the lungs and 40 cases with 16 deaths from tubercle of the intestines, but this place was virtually a convalescent depôt, owing to the accumulation there of old and decrepit prisoners; Vellore (27·74) was visited by cholera. At Rajahmundry the number of admissions to hospital (chiefly from dysentery and malarial fever) was largely in excess of the provincial rate. At Nellore, which last year recorded the high death-rate of 51·5, only one death occurred on an average daily strength of 229. 283 prisoners in all died, and of these 261 were convicts, of whom 100 had been in jail for less than six months. Among diseases cholera and tubercle of the lungs proved more fatal, and dysentery and diarrhœa less fatal, than in 1900.

Bombay.

The vital statistics of the jails in the Bombay Presidency indicate an increase of sickness but a reduced mortality. The ratio per 1,000 of admissions into hospital was 964 as against 778, the average of daily sick 34 as against 25, while the death-rate was 35 as against 56·8 in the previous year. Overcrowding occurred in every jail but three; on the other hand improved dietary and other hygienic measurse were undertaken during

the year. Six jails recorded a ratio of mortality in excess of the provincial average, viz., Sind Gang 121·0, Rajkot 74·1, Bombay House of Correction 71·1, Bombay Common Jail 57·2, Ahmedabad 43·8 and Thana 39·3. The high rate in the Sind Gang was due to pneumonia, 49 out of 53 deaths being attributable to that cause. At the Bombay House of Correction there were 17 deaths from plague. Famine was, perhaps, the predisposing cause of mortality in the two Gujarati jails, Rajkot and Ahmedabad, in the latter of which more than half the number of deaths (61) occurred among prisoners within six months of admission. The mortality at the special prison at Thana was greatest among natives of the Deccan. In all there were 419 deaths, of which 367 were of convicts. Pneumonia (103 deaths) and tubercle of the lungs (37 deaths) showed increased mortality, the death-rate of the former being higher in Bombay than in any other administration. There was no cholera, but plague appeared in five jails. No deaths were reported from Aden.

Berar.

The health of the prisoners in Berar during 1901 has followed the improvement manifested in the condition of the general population and may be described as normal. Owing to the lull after the famine there was less pressure upon accommodation. The abnormally high death-rate of 79·9 per 1,000 of the previous year sank to 24·9, the ratio of admissions to hospital from 943 to 676, and the average of daily sick from 27 to 21. There were 35 deaths in all which occurred chiefly in the central jails ; 18 at Akola, and 9 at Amraoti ; in the former 16 deaths took place in the first half-year—a fact which points to the lingering of the unfavourable conditions prevalent in 1900,—in the latter there was an epidemic of influenza. Yeotmal district jail and Amraoti central jail also exhibited the highest ratios for admission to hospital. Sickness (in the Assigned Districts) was chiefly due to malarial fever, and mortality to respiratory diseases (15 deaths). Two deaths were reported from Secunderabad, and sickness was rather more prevalent than in the previous year, but the health of the prisoners was on the whole good.

V.—VACCINATION.

General results.

During 1901-02 there were 8,036,444 persons vaccinated in the several provinces of India, being an increase of 162,052 on the number of the previous year. The increase was spread over six provinces, chief among them being Bengal and Madras. In the five provinces showing a decrease Bombay came first with a falling off of nearly 140,000, followed by Burma with a decrease of nearly 60,000, the Punjab with 40,000, and the Central Provinces with 30,000. Plague and the effects of famine caused the decline in Bombay and the Punjab, and the effects of famine affected work in the Central Provinces. According to age, 3,167,075 children under one year of age, and 3,209,462 children between the ages of one and six years were successfully vaccinated during the year. The proportion of population protected against small-pox by the year's operations ranged from 49·2 in Coorg to 20·5 in Ajmer-Merwara. In the vaccination of infants the best results were obtained in Berar, the Punjab, the United Provinces, and the Central Provinces, and the worst in Burma and Coorg.

Statement showing the total number of persons successfully vaccinated during the year 1901–02 :—

Province.	Population among whom Vaccination was carried on (Census of 1891).	Number of Persons vaccinated.	Ratio of successful Vaccinations per 1,000 of Population.	Number of Children successfully vaccinated.		Percentage of Children born during the Year (calculated at 40 per 1,000 of Population) successfully vaccinated.
				Under One Year of Age.	Between One and Six Years of Age.	
Bengal	74,801,731	2,662,826	34·34	775,729	1,482,590	25·93
United Provinces of Agra and Oudh.	47,960,667	1,580,195	31·37	873,598	486,009	45·54
Punjab	20,274,136	668,144	28·21	377,482	92,008	46·55
North-West Frontier Provinces	2,119,291	70,993	29·92	32,194	20,325	37·98
Burma	10,478,617	360,224	29·98	80,448	156,890	19·19
Central Provinces	11,873,029	425,392	33·80	211,296	94,902	44·49
Assam	6,126,343	280,827	44·46	64,747	175,835	26·42
Madras Presidency	38,227,818	1,325,106	30·51	356,467	581,875	23·31
Bombay Presidency	21,576,105	521,706	21·49	323,745	98,252	37·51
Berar	2,897,040	120,418	29·9	62,432	14,292	53·88
Coorg	180,607	9,772	49·15	905	4,063	12·53
Ajmer-Merwara	476,912	10,841	28·55	8,032	2,421	42·11
TOTAL	236,992,296	8,036,444	31·36	3,167,075	3,209,462	33·41

Bengal.

The total number of vaccinations performed in Bengal during 1901–1902 was 2,662,826 of which 2,568,798 were successful, against corresponding figures in 1900–1901 of 2,346,311 and 2,248,015. This shows an increase of 316,515 vaccinations in 1901–1902, which was spread over almost all the districts of the province, the increase being most striking in Mymensingh (43,215), Midnapore (35,927) 24-Parganas (33,177), Backergunge (25,766) and Faridpur (23,720). In the first three of these districts the increase was chiefly occasioned by the severe epidemic of small-pox with which they were visited. Only four districts reported a decrease, the most marked case being Dacca where the vaccinations were fewer by 11,934. The primary operations numbered 2,529,778, of which 95·04 per cent. were successful. According to age,

775,729 of the successful primary vaccinations were of children under one year of age, and 1,482,590 were between one and six years. For the whole province the successful vaccinations were in the proportion of 34·34 per 1,000 of the population. Estimating the births during the year at 40 per 1,000, the percentage of infants successfully vaccinated was 25·9.

Three methods of vaccination are practised in the province—(1) with lymph taken direct from the calf, from which 323,884 operations were performed; (2) with lanoline lymph, 244,244 operations; (3) with human lymph taken by arm to arm transfer, 1,961,650 operations. Compared with the previous year's figures there was an increase of 43,352 in the number of primary operations performed direct from the calf.

As regards the attitude of the people towards vaccination the Sanitary Commissioner reports that "there is scarcely any district in Bengal where there is not some opposition in some form or other. Infant vaccination is very unpopular in most parts of the province. Parents hide their children from the vaccinators in the belief that the operation would cause them pain and lead to suffering and disease. In fact deaths from other causes months after children are vaccinated are attributed to vaccination."

United Provinces of Agra and Oudh.

Steady progress continues to be made in vaccination work in the United Provinces of Agra and Oudh in spite of the presence of plague. "In the nature of things," the Sanitary Commissioner remarks, "vaccination must always be carried out among the most uneducated classes, and among people suspicious to a degree. The work of vaccination has been slowly built up step by step, year by year, and it says much for the confidence placed in officials, that even during a period when plague has attacked the provinces, no great falling off or opposition to vaccination has been observed, and that even a gratifying increase in work can be shown." During the year under notice 1,580,195 persons were vaccinated, being an increase of 30,962 on the number in 1900–1901. The increase was shared in by 31 out of the 48 districts, and in several instances the increases were over 1,000, the highest being 3,373 in Allahabad. The primary vaccinations numbered 1,490,966, of which 97·71 per cent. were successful. The number of persons successfully vaccinated per 1,000 of population was 31·37, against 31·11 in the previous year. Estimating the birth-rate at 40 per 1,000, 45·54 per cent. of children born during the year were successfully vaccinated. Bovine lymph is only used to a very small extent in the province, the total number of primary operations performed with pure calf lymph being only 18,132, of which 97·34 were successful.

Punjab.

Excluding the figures for the frontier districts, transferred to the new province, the aggregate number of vaccinations in the Punjab in 1901-02 was 668,144, as compared with 713,951 in the preceding year. The falling off is accounted for by a decrease in the number of births, scarcity, malarial fever, a general unhealthiness which rendered children unfit for vaccination, and other causes. The primary vaccinations numbered 511,121, with a percentage of success of 93·92. The decrease is most notable in the Gurdaspur, Umballa, Lahore, and Ludhiana districts, where the decrease in primary cases varied in round numbers from 9,000 to 5,000. The number of successful cases among children under one year of age fell from 462,392 or 55·7 per cent. of the births, calculated at 40 per 1,000 of population, to 377,482 or 46·5 per cent. The provincial ratio of persons successfully vaccinated per 1,000 of the total population was 28·2, against 33·3 in the previous year. The highest proportion of persons successfully vaccinated per 1,000 of population was as usual in Kangra district. It is reported that the good work there has practically stamped out small-pox. The Vaccination Act was not extended to any additional town during the year.

North-West Frontier Province.

In the North-West Frontier Province the aggregate number of vaccinations performed in 1901–1902 was less by 7,486, as compared with the previous year. Out of the total of 70,993 vaccinations, 63,321 were primary cases, and of these 91·03 were successful. The falling off was entirely in primary vaccination, as the number of re-vaccinations rose from 4,865 to 7,672. Of the successful primary cases more than two-thirds were vaccinated from animal lymph, while only 1,738 cases were from human lymph. The prejudice against vaccination is reported to be disappearing, and the practice of inoculation to have almost ceased. "One inoculator," it is stated, "is working in Boner, and the Bonerwalas bring their children into British territory to be vaccinated."

Burma. The total number of persons vaccinated in Burma during the year 1901–02 was 360,224, as compared with 410,461 in the previous year, showing a decrease of 50,237 operations. Out of 333,657 primary cases, 90·1 per cent. were successful, against 91·7 in the previous year. The number of infants protected was 80,448, equal to 19·9 per cent. of the estimated number of births. The returns for the Rangoon municipality still continue to be unsatisfactory. Calf lymph is used generally throughout the province, arm-to-arm vaccination being resorted to when the supply of animal vaccine fails. Inoculation is said to be freely carried on throughout the province, and Civil Surgeons generally, the Sanitary Commissioner states, report that it is favoured and supported by the majority of Burmans.

Central Provinces. In the Central Provinces 425,392 persons were vaccinated during the year, showing a decrease of 30,005 on the number of the previous year. The falling off was entirely under primary vaccinations, and was due to a low birth-rate, the poor health of the people, and the closing of the famine camps. Primary vaccinations fell from 385,493 to 350,484, and the percentage of success was 96·80 against 96·57 in 1900. The ratio of successful vaccinations in the year to the total population was 33·80 per 1,000, as compared with 33·42 in 1900–01. In the protection of infants there was a falling off of 7,528, the number vaccinated under one year of age during the year having fallen from 218,824 to 211,296. Animal lymph was used in the bulk of the vaccinations, and worked very successfully. Arm-to-arm vaccination is practised in very few places. With the lymph obtained from calves 208,613 children were vaccinated during the year, and of these 95·63 per cent. were successful. The use of glycerinated calf lymph was attended with satisfactory results, the percentage of success attained being 90·96 against 86·97 in the previous year.

Assam. During the year 1901–02 280,827 vaccinations were performed by all agencies in the province of Assam, showing an increase of 9,361 on the previous year's work. Of the total operations 271,600 were primary cases, and of these 97·48 per cent. were reported as successful, against 95·99 in the previous year. The province contains only 13 circles, municipalities, unions, cantonments, &c., where vaccination is compulsory under the Act, and in these nearly 80 per cent. of the available children under one year of age were vaccinated against 70 per cent. in the previous year. In the town of Nowgong no less than 94 per cent. of the available children were protected. The number of infants successfully vaccinated in the province was 64,747, representing only 26·4 per cent. of the births estimated at 40 per 1,000 of the population, and the proportion of the population successfully vaccinated in the year was 44·5 per 1,000. The Vaccination depôt at Shillong continued to work successfully, and 395,317 tubes were loaded with calf lymph against 387,557 in the previous year.

Madras. The total number of vaccinations performed in the Madras Presidency during 1901–02 was 1,325,106, being an increase of 67,223 on the operations of the previous year. The increase was partly due to the extension of vaccination to Local Fund areas and partly to the fact that the people are abandoning the idea that vaccination is a means of infecting them with plague which operated detrimentally to vaccination in the two previous years. Of the total, 1,235,196 were primary cases, of which nearly 90 per cent. were successful. The number of children under one year of age successfully vaccinated rose from 350,763 to 356,467, which represented only 23·3 per cent. of the estimated births. Vaccination is compulsory in all municipalities, and the number of operations performed by municipal vaccinators rose from 131,195 to 146,010. In the town of Madras the number of operations performed was 38,265, an increase of 5,694 on the previous year. Of the 21 districts, nine recorded a decrease of work. Chief among the causes assigned for the decline is incompleteness of staff and insufficiency and inertness of lymph. Nearly all the operations were performed with animal lymph, and the best results were obtained, as usual, from calf-to-arm vaccination, with a percentage of success of 98·4.

Bombay. There was again a considerable decrease in the number vaccinated in the Bombay Presidency in 1901–02. The number of operations fell from 661,001 operations in 1900–01 to 521,706. The decrease occurred in all the districts and is attributed to a low birth-rate consequent upon the incidence of famine and plague. The total primary cases fell from 586,478 to 470,517, the percentages of success being respectively 90·86 and 91·9. Animal and human lymph were used in the Presidency during the year. In the

use of the former the ratios of success in the registration districts ranged from 89·8 to 70·9 per cent., and in the latter from 93·4 to 86·8 per cent. In the City of Bombay vaccination with animal lymph has been in use for many years past. Of the successful primary cases 74 per cent. were infants under one year of age. Reckoning the births in the Presidency at 40 per 1,000 of population, 37·5 per cent. were protected from small-pox. No inoculation was reported to have been practised anywhere during the year, and no instances were reported of any disease having been communicated through vaccination. The protection afforded to the population by the year's operations was in the ratio of 21·5 per 1,000.

Berar.

Vaccination work in Berar regained some of the ground lost in the previous year, owing to famine conditions and epidemic disease, the number of persons vaccinated having risen from 107,788 in the previous year to 120,418, or an increase of 12,630. The primary vaccinations rose from 74,707 to 82,296; and in each year the proportion of success was 96·6. Estimating the births at 40 per 1,000 of population, 53·9 per cent. were protected against small-pox, and the proportion of population protected by vaccination rose from 27·3 per 1,000 in the previous year to 29·9. Lanolinated lymph manufactured at Amraoti was used exclusively, and was found as efficacious as the pure calf lymph and more economical. The Sanitary Commissioner gives some striking figures showing the efficacy of vaccination in checking small-pox mortality in Berar; the ratio of successful vaccinations per 1,000 of population has risen from 8·92, the mean of five years 1868–69 to 1872–73, to 33·6, the mean of five years ending 1897–98; the mortality from small-pox for the same periods has declined from 2·02 to 0·19 per 1,000. In the four years 1898–99 to 1901–02 the ratios of successful vaccinations per 1,000 of population were 34·6, 43·2, 27·3, and 29·9, and the death-rate from small-pox 0·2, 0·1, 0·3, and 0·07 per 1,000. The Vaccination Act is in force in all the municipal towns.

VI.—MEDICAL INSTITUTIONS.

Civil Hospitals and Dispensaries.

The following comparative statement shows the number of hospitals and dispensaries under official control open in the several provinces of India during 1901 and the previous year, and the number of patients under treatment :—

Provinces, &c.		Number of Institutions.	Number of In-door Patients.	Number of Out-door Patients.	Total Number of Patients.
Bengal	1901	550	49,362	3,662,477	3,711,839
	1900	532	50,097	3,417,284	3,467,381
Calcutta and Howrah	1901	17	25,989	253,615	279,604
	1900	17	28,372	251,822	280,194
United Provinces of Agra and Oudh	1901	364	55,328	3,661,957	3,717,285
	1900	365	55,394	3,577,776	3,633,170
Punjab	1901	245	51,565	2,973,446	3,025,011
	1900	273	59,328	3,379,034	3,438,362
North-West Frontier Province ...	1901	29	6,750	449,874	456,624
Burma	1901	119	39,027	858,200	897,227
	1900	113	36,095	822,594	858,689
Central Provinces	1901	103	10,592	1,337,340	1,347,932
	1900	103	13,725	1,330,261	1,343,986
Assam	1901	125	6,539	728,143	734,682
	1900	122	6,369	696,221	702,590
Coorg	1901	6	1,373	42,426	43,799
	1900	7	1,434	44,276	45,710
Madras	1901	479	64,714	4,686,978	4,751,692
	1900	478	64,269	4,621,484	4,685,753
Bombay	1901	238	45,191	1,558,603	1,603,794
	1900	237	50,888	1,485,534	1,536,422
Berar	1901	48	5,943	384,078	390,021
	1900	47	6,051	297,939	303,990
TOTAL	1901	2,323	362,373	20,597,137	20,959,510
	1900	2,294	372,022	19,924,225	20,296,247

Bengal.

The total number of dispensaries at work during 1901 in Bengal, exclusive of the medical institutions at Calcutta, was 550, an increase of 18 on the number of the preceding year. At these there were 3,711,839 patients under treatment, 49,362 being in-door and 3,662,477 out-door patients, against 50,097 and 3,417,284 respectively in the previous year. This shows a total increase of 244,458. The slight falling off in in-patients was attributed to the comparative healthiness of the year, and the rise in out-door attendance to the greater popularity of the dispensaries. There was again a satisfactory increase in the number both of women and children patients. The increase among women amounted to 47,529, the number having risen from 539,563 to 587,092. The proportion of women to the total daily attendance rose from 17·55 in the previous year to 18·29. Of the diseases under treatment at the dispensaries, malarial fevers, skin diseases, and dysentery and diarrhœa were responsible, as usual, for the largest number of cases. Of malarial fever there were 653,997 cases, equal to nearly 18 per cent. of the total number of patients, against 629,746 in 1900 ; of skin diseases the number of cases rose from 591,500 to 681,687 ; of dysentery and diarrhœa there were 177,314 cases, against 185,507 in 1900. The number of cholera

cases fell from 21,371 to 8,143. Cases of venereal diseases rose from 82,131 to 85,808. The number of deaths among in-door patients fell from 6,430 or 128·3 per 1,000 of total treated in 1900 to 5,266 or 106·7 in 1901. During the year 1,889 plague cases were treated in the dispensaries against 656 during 1900. A disease locally known as "Bhatput," which was ascertained to be prevalent in a portion of the Khondmals of the Orissa Tributary States during the rainy season of 1900 was, under the orders of the Government, investigated and pronounced to be one of virulent syphilis, "spreading rapidly in a tribe," it is stated, "which was probably uninfected until recent years, and aggravated by a low state of health brought about by famine conditions." A dispensary for the efficient treatment of the disease has since been opened. Great attention is paid in these institutions to surgery, and during the year 157,377 operations were performed, of which 230 terminated fatally. Among the more important operations there were 2,482 cases of extraction of the lens.

The following statement shows the number of in-door and out-door patients treated in the several hospitals and dispensaries in Calcutta and Howrah during 1901 and the previous year :—

Name of Institution.	1900.				1901.			
	In-door Patients.	Out-door Patients.	Total Number of Patients.	Died per 1,000 of In-door Patients treated.	In-door Patients.	Out-door Patients.	Total Number of Patients.	Died per 1,000 of In-door Patients treated.
Medical College Hospital	5,257	35,075	40,332	160·9	4,751	37,282	42,033	138·9
Eden Hospital	1,718	2,217	3,935	72·7	1,414	2,370	3,784	70·0
Ezra Hospital..	238	—	238	2·1	209	—	209	28·7
Shama Churn Law Eye Hospital	516	12,816	13,332	—	649	11,532	12,181	—
Presidency General Hospital	2,722	1,119	3,841	53·6	2,506	1,213	3,719	56·2
Campbell Hospital	8,843	23,449	32,292	323·9	7,956	23,283	31,239	281·7
Police Hospital	3,673	—	3,673	8·9	2,982	—	2,982	10·3
Mayo Native Hospital	1,703	24,209	26,002	109·8	1,788	24,835	26,623	106·2
Chandney Hospital	360	44,385	44,745	27·7	329	43,293	43,622	36·4
Park Street Dispensary	—	28,018	28,018	—	—	26,991	26,991	—
Chitpore Dispensary	—	19,380	19,380	—	—	19,255	19,255	—
Sukea's Street Dispensary	—	13,524	13,524	—	—	15,468	15,486	—
Dufferin Victoria Hospital	158	4,826	4,984	50·6	382	5,392	5,774	31·4
Sambu Nath Pandit Hospital	1,135	18,973	20,108	157·7	1,265	18,978	20,203	124·0
Kidderpore Municipal Dispensary	—	5,207	5,207	—	—	4,944	4,944	—
„ Dockyard „	—	6,731	6,731	—	—	5,935	5,935	—
Howrah General Hospital	1,959	11,893	13,852	246·5	1,798	12,844	14,642	241·9
Grand Total	28,372	251,822	280,194	172·5	25,989	253,615	279,604	153·1

The figures for 1900 show a decrease of 2,383 in in-door patients, and an increase of 1,793 in out-door patients. The increase in the latter, however, "was chiefly in-patients suffering from minor diseases, but is evidence of the growing popularity of the out-door departments of the hospitals, especially of the Medical College Hospital." The death-rate for all the hospitals was 153·1 per 1,000 of the total in-patients, against 172·5 in the previous year. Cholera patients fell from 728 to 442, and the fatal cases from 445 to 227. The decrease was most marked in the Campbell Hospital, where 154 cases were treated against 271 in the previous year. Small-pox was more prevalent in Calcutta than in the previous year, and the cases admitted to hospital rose from 253 to 463. The disease, however, was chiefly confined to Campbell Hospital which contributed 443 cases. Dysentery patients fell from 9,171 to 7,211. The number of patients treated for diarrhœa also fell from 8,949 to 7,231 ; malarial fever was responsible for 48,817 patients against 54,571. Plague cases treated rose from 449 to 458, and the deaths from 357 to 361. Venereal diseases show a small decrease of 232 patients, the number treated having fallen from 12,328 in the previous year to 12,096. Surgical operations increased from 26,023 to 27,552, and death ensued in 207 cases, against 188 in 1900.

United Provinces of Agra and Oudh.

During 1901 there were 364 hospitals and dispensaries at work in the United Provinces of Agra and Oudh, or 1 less than in the previous year. The number of patients who received medical aid was 3,717,285 against 3,633,170 in 1900. There was thus an increase in 1901 of 84,115. The number of in-patients fell from 55,394 to 55,328. In the previous year the decrease in attendance was due in a great measure to plague scares and plague preventive measures, which still deterred patients from seeking medical relief at Government charitable dispensaries ; but the returns for the year under notice indicate that many of the institutions which suffered most in this respect were again becoming popular, and that the confidence of the people in them was being re-established. Among the in-door patients there were 2,950 deaths, against 3,099, and the death-rate fell from 55·9 to 53·3 per 1,000. Of the diseases for which the patients were treated 523,227 were suffering from malarial fevers, a decrease of 54,819 on the number of 1900 ; 2,449 cases of cholera were treated in the dispensaries, against 4,679, and cases of diseases of the eye rose from 337,464 to 345,320 From venereal diseases there were 78,052 patients, against 82,884 in the previous year. The number of surgical cases rose from 182,986 to 186,561, of which 158,260 resulted in cure and 360 were fatal. Of the total operations 5,844 were for cataract, of which nearly 85 per cent. were successful, as compared with 5,373 operations and a percentage of success of 83 in 1900.

Punjab.

The number of dispensaries at work in the Punjab during 1901 was 245 or 28 less than in the previous year, the decline being due to the transference of 28 of the dispensaries reported on in 1900 to the North-West Frontier Province, consequently there was a decline in the number of patients. During the year 3,025,011 patients were under treatment, being a decrease of 413,351 on the number of 1900. The attendance of in-door patients was less than in the previous year by 7,763, the number having fallen from 59,328 to 51,565. Of the diseases for which patients sought relief there were only 121 cases of cholera, a large decrease on 4,663 in 1900. Fever cases were by far the most frequently treated, the cases of malarial fever amounting to 550,719, or 18 per cent. of the total patients. Diseases of the eye showed a decrease of 60,863 cases, the number treated in 1901 being 381,863 against 442,699. From venereal diseases there were 28,378 cases under treatment. Among the in-patients there were 2,344 deaths during the year, being in the ratio of 45·4 per 1,000 of the number treated, against a death-rate of 68·7 in 1900. The number of surgical operations amounted to 151,837, which, compared with the previous year, shows a decrease of 13,395 operations. Of the total operations, 144,995 resulted in cure and 253 were fatal. There were 6,387 cataract operations, and of these 5,204 were successful.

North-West Frontier Province.

In the North-West Frontier Province 29 dispensaries were at work during 1901, and at these the total number of patients was 456,624. Of the 6,750 in-patients 5,099 were cured, 904 relieved, 399 discharged otherwise, and 243 died. The chief maladies from which the patients sought relief were malarial fevers, diseases of the eye, ulcers and diseases of the digestive system. There were only 24 cases of cholera. The total number of operations performed was 19,650, of which 19,405 were cured, and 45 were fatal.

Burma.

The number of dispensaries existing in Burma at the end of 1901 was 119, or six more than in the previous year. At these, 897,227 patients attended, as compared with 858,689 in 1900. The number of in-door patients rose from 36,095 to 39,027, of whom 29,522 were cured, and 2,854 or 73 per 1,000 died, against 2,724 deaths or 75 per 1,000 in the previous year. About 57 per cent. of the patients treated were Burmese. Malarial fevers, as usual, headed the list of maladies under treatment, the number of cases being 145,655, against 136,619 in the previous year. Cholera was slightly more prevalent than in 1900, and the number of cases rose from 220 to 250. Cases of venereal disease rose from 29,692 in 1900 to 29,931. Surgical work showed an increase of 988 operations, the number performed during the year having risen from 19,061 to 20,049. The number of patients cured, after being subject to operation, was 19,147 and 124 died.

The figures for the Dufferin Hospital show that the total number of patients during 1901 was 1,865, of whom 253 were in-door, against 1,223 and 512 respectively in 1901. This hospital provides accommodation for maternity and for gynecological cases, besides quarters for 24 pupil midwives, who undergo a course of instruction in

midwifery and sick-nursing. Since the opening of the hospital in 1888 up to 1900, 154 nurses had passed out, and of these 14 were in the employment of municipalities.

Central Provinces.

The number of hospitals and dispensaries at work in the Central Provinces during 1901 was 103, the same as in the previous year. The total number of patients rose from 1,343,986 to 1,347,932. The increase, however, extended only to out-door patients, the in-door patients having fallen from 13,725 to 10,592. The decrease in in-patients was chiefly due to the healthiness of the year, and the consequent diminution in the number of famine waifs. Among the in-patients there were 977 deaths, or 92·2 per 1,000 of total treated, against 2,083 or 151·2 in 1900. As regards the different kinds of diseases, malarial fevers headed the list with 328,964 cases. Of cholera there were only 7 cases, against 6,566 in the previous year, and of dysentery and diarrhœa, 41,937 cases against 79,103, and of venereal diseases 29,034 cases. The number of surgical operations rose from 32,472 in 1900 to 32,809. Of these, 31,793 resulted in cure and 60 in death. Of the more important operations, 904 were for extraction of the lens.

Assam.

In the province of Assam there were 131 dispensaries at work during the year, or 3 more than in the previous year. There was a further increase in the number of patients, the total under treatment having risen from 702,590 in 1900 to 734,682 in 1901. These institutions, it is stated, are steadily becoming more useful and better appreciated by the people. The number of in-patients again rose from 6,369 to 6,539, and of these 3,994 were discharged cured, 656 relieved, 806 discharged otherwise, and 792 died, the latter representing 121·1 per 1,000 of the total in-patients, against a ratio of 140·1 in 1900. The attendance of women largely increased as compared with previous years, and is attributed to the improved accommodation offered to female patients by the introduction of separate consulting rooms. Of the total number of persons who received medical aid, malarial fever accounted for 168,370 cases, including 2,592 suffering from kala-azar, against 2,013 of these cases in the previous year; dysentery and diarrhœa 31,024, and venereal diseases 8,230. Cholera patients fell from 2,717 in 1900 to 1,052. Of surgical cases there were 15,689, of which 15,144 were cured and 27 were fatal.

Madras.

In the Presidency of Madras there were 479 civil hospitals and dispensaries working at the close of 1901, or one more than in 1900, and at these there were 4,751,692 patients under treatment, exceeding the number of the previous year by 65,939. Of the 64,714 in-door patients, 37,697 were returned as having been cured under treatment, 11,716 as relieved, and 6,934 as otherwise discharged. The deaths numbered 5,938, representing a ratio of 91·8 per 1,000 of the total in-patients. Ulcers and diseases of the skin, malarial fevers, diseases of the digestive system, rheumatic affections, and diseases of the eye were the most common complaints under treatment during the year. Cholera was more prevalent in the Presidency than in the previous year, and the cases under treatment in the various hospitals and dispensaries rose from 10,336 to 10,833. Of venereal diseases there were 93,984 cases. The surgical operations fell from 153,633 in 1900 to 151,695. Of these, 142,461 were cured and 295 were fatal.

At the Madras Voluntary Venereal Hospital, which is included in the above hospitals there were 611 female patients treated during 1901, an increase of 86 on the number of the previous year. Of these, 289 were cured and 12 died.

Bombay.

In the Presidency of Bombay, there were 238 hospitals and dispensaries working at the end of 1901. At these, 1,603,794 patients were under treatment, of whom 45,191 were in-door and 1,558,603 out-door patients, against 50,888 and 1,485,534 respectively in 1900. Malarial fevers, as usual, constituted by far the largest number of cases (417,524), and showed an increase of 54,854 on the figures of the previous year. Next to fever, eye and skin diseases and worms were the most common ailments. Cholera cases fell from 12,047 to 430; dysentery cases were also far less numerous; and patients suffering from venereal affections rose from 33,897 in 1900 to 38,258 in 1901. The number of persons admitted into hospitals for plague was 104, of whom 24 died. Of the in-door patients 30,712 were cured, 4,829 relieved, 3,003 discharged otherwise, and 4,528 died, the ratio of deaths to total treated being 106 per 1,000, against a ratio of 134 in the preceding year. The total number of patients operated on was 63,948, as compared with 62,965 in 1900, and of the former 49,251 were cured and 346 died.

Berar. There were 48 medical institutions at work in Berar during 1901, or one more than in the previous year. Of these, eight are hospitals wholly maintained by the State. The total number of patients under treatment was 390,021, against 303,990 in 1900. In-patients numbered 5,943, and of these 4,805 were cured and 435 died, which gives a death-rate of 73·0 per 1,000. The increase was entirely among out-door patients, and was accounted for by the closing of permanent dispensaries during the late famine and the opening of temporary hospitals at relief works and poor-houses throughout the province. Malarial fevers continued to head the list of diseases from which relief was sought; nearly a fourth of the total patients were treated under this head; diseases of the eye and diseases of the digestive system came next in order. The number of surgical operations rose from 9,882 in 1900 to 12,277. Of these, 12,087 were cured and 40 were fatal.

At the Lady Dufferin Hospital for women and children at Amraoti the number of in-door patients fell from 230 in 1900 to 139, and the out-door patients from 6,839 to 5,334. The number of operations performed fell from 139 to 99.

Lunatic Asylums.

Bengal. At the six asylums in Bengal (viz., Bhowanipore, Dullunda, Dacca, Patna, Cuttack, and Berhampore) 1,192 lunatics, including 249 fresh admissions and re-admissions, were under treatment in 1901, being an inecrease of 8 on the number of the previous year. In the course of the year under notice 95 patients were discharged as cured, and 27 as improved or otherwise, and 61 died. Compared with the figures of 1900, the number discharged was less by 11, and the mortality more by 39. At the end of the year there were 1,009 persons still under detention, or 66 more than at the close of 1900. The lunatics are reported to have enjoyed excellent health during the year The number of admissions to hospital fell from 968 to 576; the average daily number of sick fell from 80 to 77; while the death-rate fell from 106·7 to 61·8 per 1,000 of average strength. There was only one solitary case of cholera against 12 in 1900. Although plague raged in the neighbourhood of the Patna Asylum only one fatal case occurred in it. The patient was segregated, and happily no other case occurred. The cause of insanity was traceable only in 49·4 per cent. of the 249 fresh admissions, and 47 of these were ascribed to ganja smoking. The results of the working of dairy farms at the asylums were not so satisfactory as in the previous year. The dairy farms at Dullunda, Dacca and Berhampore showed a total profit of £63. The usefulness of the dairy farms, however, is not indicated so much in the profits as in the supply of pure milk and in the congenial work which they afford to the lunatics.

In the Bhowanipur Asylum, containing European and Eurasian patients, included in the above total, the inmates during 1901 numbered 48, or five less than in the previous year. Of this number 37 were under detention at the beginning of the year, and 11 were subsequently admitted. In the course of the year 12 patients were discharged, 4 died, leaving 32 under confinement at the close of the year. As regards the health of the patients during the year, there were only 5 admissions to hospital, against 6 in the previous year.

United Provinces of Agra and Oudh. The inmates of the four lunatic asylums (Agra, Bareilly, Benares, and Lucknow) in the United Provinces of Agra and Oudh in 1901 numbered 1,362, including 250 fresh admissions during the year, against 1,358 in 1900. Before the close of the year 189 patients were discharged, of whom 132 were reported as cured and 96 died, leaving 1,077 under treatment at the end of the year. The cause of insanity was unknown in nearly half (654) the cases under treatment.

Punjab. The new Central Lunatic Asylum for the province of the Punjab was opened on the 1st March, 1900, and within that month the patients from the old asylums at Lahore and Delhi were transferred to it, and the two institutions were permanently closed. The total number of lunatics in the Punjab lunatic asylum during 1901 was 610, including 128 fresh admissions, against 605 in 1900. At the end of the year the number was reduced to 479 by the discharge of 75 patients, and 56 deaths. As regards the health of the inmates of the asylum, the daily average sick was 54, a somewhat higher rate than 42 of the previous year, while the death-rate fell from 114·0 per 1,000 of average strength to 79·4.

The Rangoon Asylum is the only one in the province of Burma, and has accommodation for 416 insanes. The maximum number confined in any one night was 425. During 1901 there were 522 patients in the asylum, including 132 fresh admissions, and the total was reduced at the close of the year to 421 by the discharge of 65 patients for different causes and the death of 36. As regards the general health of the inmates, the daily sick rose from 17·1 to 29·3, and the deaths from 23 or 60·9 per 1,000 of average strength to 36 or 88·0. **Burma.**

In the two asylums of the Central Provinces (Nagpur and Jubbulpore) there were 354 lunatics under treatment during 1901, a decrease of 39 on the number in 1900. In the course of the year 33 patients were discharged as cured or otherwise and 20 died, leaving 301 still under treatment at the end of the year. The health of the inmates was better than in the previous year. The daily average sick at Nagpur fell from 10 to 9, and at Jubbulpore it was about the same (3). "Many of the inmates of the former asylum," the Medical Officer states, "are mere wrecks of men and women; an unhealthy season tells heavily upon them." Of the total 20 deaths, Nagpur recorded 10, being in the ratio of 67·6 per 1,000 of average strength, against 19 or 115·2 in 1900. At Jubbulpore there were 10 deaths, being in the ratio of 63·3 per 1,000, against 4 or 24·8 in 1900. Of the 301 patients under treatment at the end of the year the cause of insanity was unknown in 224 cases. **Central Provinces.**

There is only one lunatic asylum in the province of Assam, and this is situated in Tezpur. The total number of lunatics under treatment in the asylum during 1901 was 148, or two less than in the previous year. Of these, 34 were fresh admissions. At the close of the year the patients in the asylum were reduced to 130, 13 of the total number having been discharged, and 5 having died. The daily average sick was 8, and the number of deaths was less by 12 than in 1900, and the death-rate fell from 138·6 per 1,000 of average strength to 41·9. The causes of insanity were unknown in 19 of the fresh admissions. **Assam.**

At the commencement of 1901 there were 559 patients under treatment in the three lunatic asylums (Madras, Vizagapatam, and Calicut) of the Madras Presidency. During the year 155 fresh cases were admitted, bringing the total population up to 714, or one less than the number in the preceding year. In the course of 1901 there were 93 cases of discharge, and of these 66 were cured or improved. The accommodation was ample, and there was no overcrowding in any of the asylums during the year. On the whole there was less sickness among the patients than in the previous year. The daily average sick fell from 74 to 61, but the deaths rose from 49, or 89·8 per 1,000 of average daily strength, to 53 or 94·2. The excess mortality is more than accounted for by cholera, from which there were 4 deaths in Madras Asylum and 3 in the Calicut Asylum. Of the total 53 deaths the Madras Asylum contributed 35, giving a death-rate of 87·4 per 1,000 on an average strength of 400, against a ratio of 104·2 in 1900. The death-rates of the other two asylums, Vizagapatam and Calicut, were 55·5 and 154·6 per 1,000 respectively, against 57·0 and 49·0 in the previous year. Of the 155 fresh cases in the Madras Asylums 16 were under 20 years of age and 104 were between the ages of 20 to 40. The causes of insanity were unknown in 90 or 58·0 per cent. of the new admissions. **Madras.**

The total population of the six lunatic asylums of the Bombay Presidency (Colaba, Ratnagiri, Poona, Dharwar, Ahmedabad, and Sir Cowasji Jehangir, Hyderabad) was 1,069, including 310 fresh admissions, against 1,089 in 1900. In the course of the year 219 patients were discharged, 69 of them as cured, and 77 died, leaving 773 under treatment at the close of the year. There was slightly less sickness in the asylums than in 1900, the daily average sick having fallen from 42 to 41, and the death-rate from 178·0 per 1,000 of average strength to 100·0. The highest death-rate was recorded at the Ahmedabad Asylum, viz., 108 per 1,000 of average strength. Of the total of 1,069 lunatics, the causes of insanity were unknown in 450 cases. **Bombay.**

Medical Schools.

The number of medical schools open in Bengal during 1901–02 was 10, or one more than in the previous year. The Medical College, Calcutta, and four of the medical schools are maintained by Government, the rest are unaided. The college is affiliated to the **Bengal.**

University, and prepares candidates for its various medical degrees. The four Government medical schools train pupils as Civil Hospital Assistants, and the five unaided schools follow their own standards for private practice.

The students of the Medical College are required to undergo three University examinations during their five years' study, viz., the Preliminary Scientific examination at the end of the second year, the first L.M.S. or the first M.B. examination at the end of the third year, and the second L.M.S. or second M.B. examination at the end of the fifth year. The total strength of the College at the end of the session 1901–02 was 599 (including 13 women), against 569 in the preceding year. As regards the examinations, 267 candidates were successful, or at the rate of 44·57 per cent., as compared with 42·29 per cent. in the previous year. Of the 267 successful candidates, 32 passed the Preliminary Scientific L.M.S. examination, 51 passed the first, and 64 the second L.M.S. examinations; 89 passed the Preliminary Scientific M.B. examination; nine passed the first and two the second M.B. examinations. In the combined Preliminary Scientific and First L.M.S. examinations ten passed; and the same number passed the combined Preliminary Scientific and First M.B. examinations.

Sixty-two certificates were issued to pupil nurses and 45 for native *dais*.

The average number of students attending the four Government Vernacular Medical Schools at Calcutta, Patna, Dacca and Cuttack was 694 (including 45 women). 112 pupils passed the final examination. One female pupil was successful from each of the Temple and the Orissa Medical Schools, while 50 per cent. of the female candidates passed from the Campbell Medical School, Calcutta.

United Provinces of Agra and Oudh.

The number of pupils attending the Agra Medical School in 1901–02 was 242 (including 52 women), or 10 more than in the preceding year. The results of the examinations are reported to have been satisfactory, especially in the case of the female students. The pupils are carefully examined at the end of each year's work, and are not promoted to the next higher class unless they pass the annual examination of their class.

Punjab.

The average attendance at the Lahore Medical College and School was more by 29 as compared with that of 1900–01, viz., 472 against 443. Of these 181 were in the College and 291 in the Medical School. "The success of the graduates," the Local Government remark, "who pass out of the College in their subsequent careers is very gratifying. A considerable number have proceeded to England and obtained qualification there, and many fill with distinction appointments both in the Punjab as well as other provinces in India." The results of the year's examinations show that for the Preliminary Scientific Examination 29 out of 47 candidates passed. In the first L.M.S. and M.B. examinations 12 candidates out of 19 passed, against 23 out of 45 in the previous year, and in the second L.M.S. and M.B. examinations eight out of 30 passed, against 21 out of 43; in all 49 out of 96 or 51 per cent. were successful, as compared with 58 out of 111 or 52 per cent. in the previous year. In the final examination for the hospital assistant diploma 28 passed out of 64, which is considerably below the average.

The Medical School for Christian women continues to make progress and to do good work at Ludhiana. The object of the institution is "to provide a thorough medical training, under fully qualified Christian women, for those Christian women and girls who wish to prepare themselves for medical mission work." At the end of 1901 there were 44 students on the rolls, or one more than in the previous year; of these 14 belonged to the Medical class, three to the Compounders' classes, 11 to the Midwifery class, and 16 to the Nurses' classes.

Madras.

The number of students at the Madras Medical College (including the School Department) during 1901–02 was 524, of whom 26 were women students. In the Hospital Assistant Department, consisting of 209 pupils, 55 appeared for the final examination and 48 passed. The results of the several University examinations in medicine were again unsatisfactory, only 40 having passed out of 81 candidates entered, against 31 out of 68 in 1900. Of the 524 students 489 completed their curricula, 209 of them studied in the Hospital Assistant Department, 135 in the College Department, 103 in the Apothecary Department, and only one in the Chemist and Druggist Department.

The only other medical school at work during the year was the Prince of Wales' Medical School, Tanjore. At this there were 19 pupils on the rolls, all of whom

were being prepared for the Hospital Assistants' Certificate. Nine candidates appeared for the final examination and 5 passed.

Bombay.

The attendance at the Grant Medical College, Bombay, rose from 439 in 1900–01 to 569 (including 45 women) in 1901–02. For the first University examination in medicine 157 candidates presented themselves, of whom 104 passed; and for the second examination in medicine 90 passed out of 169 candidates. For the final examination for the degree of L.M.S there were 62 candidates, and of these only 28 passed.

The Government Medical Schools at Poona, Ahmedabad, and Hyderabad continued to work satisfactorily. The average number of students on the rolls was 235 (including five women).

VII.—SANITATION.

Bengal.

In Calcutta the improvement of bustees, or clusters of native huts, continued; work was in progress or in contemplation in more than 100 bustees. Some progress was also made in the extension of the filtered and unfiltered water supply, and a scheme was worked out for the prevention of waste and for a continuous supply. The average daily consumption of filtered water was 20,433,227 gallons, equal to over 24 gallons per head of the population. The Health Officer reports that the quality of the filtered water compares very favourably with that of the largest towns in Europe. The total length of filtered water mains and services amounted to nearly 317 miles on the 31st March, 1902. Arrangements were being made to extend the unfiltered supply to all the sewered roads throughout the city, thus directly relieving the demand for filtered water. The total mileage of unfiltered water pipes was 158 miles. The reconstructions connected with the Suburban Drainage Scheme progressed but slowly, pending a reference to Mr. Latham, the English expert, but greater expedition is anticipated in carrying out the scheme as approved by Government. Four lakhs of rupees were expended during the year on the town and suburban sewage outfall and the works connected therewith, the most important work in hand being the completion of the main sewer from Kidderpore to Ballygunge and of the outfall. A surface drainage scheme for the suburbs was in preparation.

The municipalities of the interior of Bengal spent £146,912 or nearly 45 per cent of their income on sanitary works (original and recurring) during the financial year 1900-01, being an increase of £6,426 on the expenditure of the previous year. This was distributed over all the important heads of sanitation, especially drainage and conservancy. The expenditure on conservancy has increased since 1895 by over £20,000. Various sanitary works were also undertaken or completed in towns and rural areas, by municipalities, district boards, Government, and private individuals, at a total cost of over £68,000.

The Sanitary Board held only one meeting during the year, but continued to advise the Government and local bodies on the important sanitary projects of the year. Among these were schemes for the improvement of the water supply of Howrah, the Garden Reach Municipality, a complete project for the surface drainage of Manicktollah, and drainage schemes, of varying magnitude, for the municipalities of Dinajpur, Monghyr, and Titaghar. Among the more important preliminary estimates prepared under the order of the Board were those for the Narayangunge waterworks, the Rangpur drainage scheme, the Patna Distillery water-supply improvement, and a combined scheme for water supply to the riparian municipalities.

United Provinces of Agra and Oudh.

No details regarding municipal or district board income or of the expenditure on sanitation in the United Provinces of Agra and Oudh appear in the report. In the towns of Agra, Allahabad, Benares, Cawnpore, Lucknow, Meerut, Mussoorie, Dehra Dun, and Naini Tal, containing about one-third of the municipal population of the province, the great water-supply works continued to work well. At Agrà the quality of the water supplied greatly improved, in Benares extensive sewerage works were in progress, while at Lucknow and Cawnpore important sewerage and drainage schemes were under consideration. Village sanitary inspection books are now kept up in almost all districts and are inspected by district officers on tour; by this means, it is anticipated, "much can be done to improve the general health of those living in rural areas."

The Sanitary Board met five times in the course of the year, when projects and estimates amounting to £48,300 were considered. The Board noted with satisfaction the continued attention which was paid to improving the sources of water supply and to the general improvement manifested in the sanitary condition of villages to which the Village Sanitation Act III of 1892 has been applied.

Punjab.

In the Punjab the municipal towns spent over £81,000 on sanitary works during 1901. The record of sanitary progress for the year was satisfactory. Among the more important schemes completed, were the extension of the Delhi waterworks and the drainage of Abbotabad and Fázilka. At Simla progress was made in the

extension both of the water-supply and of the sewerage system, 14 out of 18 miles of main being laid for the latter purpose during the year; an experimental installation was also set up for the biological treatment of sewage. There were under consideration projects for the drainage of the Simla bazaars and of the towns of Rawalpindi, Multan, and Ferozepore. Several schemes were being recast owing to financial difficulties. The estimate for the Amritsar waterworks, amounting to over £83,000, was sanctioned by the Government of India early in the year. The sale of manure by the municipal towns of the province brought in £10,000 to municipal funds. As regards rural sanitation there remains room for great improvement, though the system of village sanitation note-books was maintained and extended and the work of clearing and repairing wells continued.

The Sanitary Board held five meetings during the year, at which schemes were approved for the drainage of Chunian, Umballa (extra-mural), Chiniot Road Town, Gujrat, and Lyallpur, and for the water-supply of the latter place. Rules for the distribution of executive work between the sanitary engineer and the Sanitary Board were drawn up and submitted to Government, and a standing sub-committee was constituted for the preliminary discussion of projects submitted for approval.

North-West Frontier Province.

The municipal towns of the North-west Frontier Province spent over £7,000 out of their total income of £43,234 on sanitation. No large works for improving water-supply were undertaken during the year, but projects were under consideration for extension of the present supply at Kohat and Abbotabad. Drainage schemes were in progress at Peshawar, Kohat, and Bannu, and under consideration for Dera Ismail Khan. The sale of manure and street sweepings brought in £1,150. The work of repairing and cleaning wells continued, especially in the Dera Ismail Khan District. Sanitary note-books were distributed as usual.

Central Provinces.

Of the sanitary works undertaken by the Public Works Department of the Central Provinces, the increase in the storage capacity of the Ambajheri reservoir at Nagpur was the most important. This work, begun during the famine, was pushed forward practically to completion; further additions were also made to the Wardha waterworks. The chief municipal improvements effected during the year were the construction of drains at Nagpur and Jubbulpore, the cost being partly borne by municipal funds and partly recovered from the persons chiefly benefited. Of the total income of district headquarters municipalities for the year 1900–01, some $33\frac{1}{3}$ per cent. was spent on sanitary works, original and recurring. "The expenditure" under this head, it is observed, "whether under the direction of the Sanitary Board or otherwise, was very small." Owing to the recent famine neither funds from the District Councils nor subscriptions from private persons were readily forthcoming. The work of sanitary improvement was thus considerably restricted, and in some places brought to a standstill. The machinery of the Sanitary Board was made more workable by the abolition of the Central meetings and the substitution of District consultations. Four such consultations took place during the year in the Jubbulpore, Narsinghpur, Hoshangabad, and Nimar districts. The provisions of the Village Sanitation Act were extended to two fresh villages during the year under review.

Burma.

Although the income of the 42 municipalities in Burma was considerably higher than in the preceding year (£440,000 against £310,000), a much smaller proportion was spent on sanitary works; only 35 per cent. was assigned for this purpose, or 20 per cent. less than in 1900. The decrease was spread over all the main heads of sanitary expenditure—conservancy, water-supply, and drainage. Towards the end of the year work was commenced on projects for the water-supply of Moulmein and Rangoon, estimated to cost £62,000 and £26,000 respectively. Schemes for the water-supply of Meiktila, Akyab, Myingyan, and Minbu, and smaller schemes for other towns, were further considered during the year. On rural sanitation a sum of £10,000 was expended during the year from district cess funds. A number of municipalities had important schemes on hand which they are unable to carry out for want of funds; the question of rendering assistance from provincial revenues was receiving the consideration of the Local Government.

Assam.

No sanitary work of capital importance was undertaken during the year in Assam, nor was there any large provincial scheme under consideration. The municipalities,

however, excluding four towns which have no separate income of their own, spent £8,200 or over 55 per cent. of their income on sanitation; of this total conservancy absorbed considerably more than half. The municipality of Dhubri spent nearly 90 per cent. of its income on sanitation, Gauhati and Tezpur and the Habiganj union followed with upwards of 65 per cent., and the other bodies with two exceptions, spent upwards of one-third. The sanitary expenditure of the various local boards was almost entirely confined to effecting improvements in the water-supply by the construction of wells and the excavation of tanks. The system of sanitary inspection books was kept up in certain villages, but owing to lack of interest in sanitary matters was productive of few good results. The Sanitary Board held only one formal meeting during the year, the papers being circulated to members as occasion arose.

Madras.

In Madras City a sum of £16,300 was expended on new works during the year. The bulk of the amount was incurred on the new drainage scheme. The quantity of water supplied from the Red Hills Lake was about 10 per cent. greater than in the previous year; but the level of the lake was lower at the close of the year than at the beginning, and pumping had to be taken in hand from the commencement of April to the middle of October.

Details are lacking as to the proportion of sanitary expenditure to income among the municipalities and district boards in the Madras Presidency. The construction of the waterworks extension and protective works at Trichinopoly which were commenced in 1900 were still in progress—the extension to Worriur one of the suburbs being the only work of capital importance completed during the year. Some progress was also made in connection with the Vizagapatam and Coconada waterworks, and the scheme for the water supply of Ootacamund from the Tiger Hill reservoir. District medical and sanitary officers inspected and reported on 424 towns and villages; the action taken as a result of their reports has effected valuable improvements in respect of village water-supply, conservancy, and the sanitation of schools. Sanitary inspection books were satisfactorily maintained during the year. Progress in sewage farming, sewage filtration, and the employment of town sweepings and nightsoil for agricultural purposes continues to be made. The Government accorded sanction to a series of experiments on the use of sewage filtrates as fertilisers.

The Sanitary Board scrutinised the plans and estimates of 85 sanitary works, of which 38 were for municipalities, 43 for local fund boards, three for the collector of Madura and one for the collector of Salem. The total estimated cost of these projects was £96,000. Schemes for the water supply of Erode, Kumbakonam, and Ongole were among the more important of those examined and submitted to Government. Proposals for many other schemes were considered by the Board but were not sufficiently advanced for estimates to be prepared.

Bombay.

In Bombay City good progress was made with the various drainage works, but the proposed works for the drainage of the lower parts of the city, which had received the sanction of the Corporation, had not been taken in hand. Drainage connections were carried out for 4,132 houses at a total cost of £6,800, and a sum of £7,207 was expended on miscellaneous drainage. The various municipal waterworks were maintained in a state of efficiency. During the year 158 water connections were made, bringing the total up to 20,552. The Tansa and Tulsi Lakes were well replenished by the rainfall. In view of continued complaints about the bad quality of the Tulsi water a pipe scraper was passed through the main, the result being not only an improvement in the quality of the water but an increase in quantity.

The other 165 municipalities in Bombay Presidency spent rather less than 20 per cent. of their income, or £95,000, on sanitary works. The expenditure of the local boards on water supply and drainage was only 4·24 per cent. of income. The continued presence of plague necessitated considerable expenditure, while the prevalence of famine reduced the funds available, and thus few sanitary projects of great importance were undertaken during the year. The same causes prevented any progress being made in extending the Bombay Village Sanitation Act, 1889, to fresh villages. Sanitary inspection books were in use in 3,395 selected villages.

The Sanitary Board considered and tendered advice concerning several projects, among which the more important were the following:—Schemes for the water-supply of Kaira and Mehmedabad; plans and estimates for the water-supply of Ahmednagar, which were approved by Government; and a modified scheme for the drainage of Poona, the com-

plete project for drainage and water-supply submitted in the previous year having been vetoed by the Government of India on account of the excessive cost. Considerable progress was made in connection with the Poona sewage farm at Manjri ; 15 acres of land had been acquired and fenced in and experiments were in progress.

The municipalities of Berar spent 36 per cent. of their income on sanitation as compared with 45 per cent. in 1900. A similar decrease took place in the sanitary expenditure of district boards, especially those of Akola and Amraoti, under the heading of water-supply. Little progress was made in the sanitary survey, 111 villages only being surveyed ; 37 towns and 1,373 villages have been, two towns and 3,870 villages have still to be, surveyed. The District Sanitary Board met as usual once at each of the six headquarter stations to consider the action taken on the suggestions of the Sanitary Commissioner, as recorded in his remarks on towns and villages surveyed in past years. Berar.

India Office,
November, 1903.

ABSTRACTS

OF

SANITARY AND OTHER REPORTS

FOR

1901.

15131

ABSTRACT OF THE REPORT OF THE SANITARY COMMISSIONER WITH THE GOVERNMENT OF INDIA, FOR 1901.

(*Surgeon-General Sir B. Franklin, K.C.I.E., I.M.S.*)

Meteorology of the Year.

Summary of the meteorological conditions of the year.—The following report on the meteorology of India has been kindly furnished by the Meteorological Department of the Government of India :—

A series of depressions entered North-West India and advanced eastward across Northern India during the month of January, and temperature changes were consequently frequent during that month. The warm and cool waves usually preceding and following depressions of the winter type were, however, less well-marked than is the case when the depressions are separated by longer intervals of time. The mean maximum temperature of the whole month was in moderate to large defect over the whole of Northern India and the north of the Peninsula, but the variations from the normal were more irregular and less strongly marked in minimum temperature. Both maximum and minimum temperatures were in slight to large excess over the southern half of the Peninsula. The conditions in February closely resembled those of January. The temperature changes were again frequent, due to the same cause. The mean minimum temperature of the month was again in moderate to large excess over the southern half of the Peninsula, but the excess in maximum temperature shown over the same area in January had disappeared and the mean maximum temperature of the month was normal in that region, while it was in slight to considerable defect in the north of the Peninsula and the whole of Northern India, except Assam and parts of Bengal. The minimum temperature of the month was in moderate to considerable defect in the West Punjab, Sind and Gujarat, in moderate excess in North-East India and in moderate to large excess in Bengal. An interesting feature in the temperature conditions of February was the unusually low temperature experienced in Gujarat, shown in both maximum and minimum temperatures. Two well-marked cool waves crossed India during the month of March, the first from the 7th to the 12th and the second from the 23rd to the 30th. The principal abnormal features in the mean temperature of the month were an excess of temperature in the West and Central Punjab, Sind and Gujarat and a defect in the east of the Gangetic Plain, Chota Nagpur, the Central Provinces and the south-east of the Peninsula. The variations from the normal were shown chiefly in maximum temperature in the areas of defective temperature and in Sind and Gujarat, and in minimum temperature in the West and Central Punjab. Maximum temperature was in moderate to large excess in North-West Burma and the adjacent districts of Assam and Bengal. In April temperature was below the normal in Baluchistan, and a considerable part of North-West India, especially in Baluchistan, the Punjab and the west of the United Provinces, and the defect was shown in both maximum and minimum temperatures. The variations from the normal on the mean of the whole month were comparatively small and unimportant in other parts of the country. On the 11th a cool wave appeared in the extreme north-west, but it did not influence the temperature outside of the Punjab to any important extent. Another cool wave appeared over Baluchistan and the Punjab on the 17th and travelled across India as far as Bengal. A marked fall of temperature accompanying fairly general rain occurred on the 26th to 28th in the Peninsula, especially in the south. In May the mean maximum temperature for the whole month was slightly to considerably below the normal over the greater part of the Punjab and slightly below in parts of the interior of the Peninsula. It was slightly to moderately above the normal in Sind, the South-west Punjab, and the Central India Plateau. Minimum temperature was also in excess over the same region and in defect in parts of the Punjab and of the interior of the Peninsula. From the 5th to the 10th minimum temperatures from 10° to 23° below the normal were recorded in Upper India. Maximum temperature was still more largely below the normal during this period, and at several stations on the 5th to the 7th was from 20° to 27½° below the normal. The highest maximum temperature recorded during

the month was 123° at Jacobabad on the 30th, which has only twice previously been equalled in the month of May. In the month of June temperature was in very general excess, due chiefly to the failure of the monsoon to extend into the interior districts. Both maximum and minimum temperatures were in moderate to large excess over the central parts of the country, the excess in the former being most strongly marked in the Gangetic Plain, the eastern states of Central India and Chota Nagpur. The highest maximum temperatures recorded this month in the divisions of Bengal, Bihar, Chota Nagpur and the United Provinces were the highest on record for June. Both maximum and minimum temperatures were below the normal on the mean of the month in Baluchistan, Afghanistan and the Kashmir mountain districts, probably due to late snow on the higher ranges of the Himalayas. Rain was again in general defect in July and temperature was again in moderate to large excess over the greater part of the country, the area of largest excess, however, being this month shown further west, chiefly over the Central India Plateau and the Gangetic plain, where both maximum and minimum temperatures were in moderate to large excess. On the 6th Jacobabad reported a maximum temperature of 126°,—a temperature which has been recorded only once during the past 25 years, *viz.*, on the 13th June, 1897. In August rainfall was light in North-West India and the south of the Peninsula and was fairly continuous elsewhere, especially in the central parts of the country. The variations from the normal of temperature were closely related to the distribution of rainfall. Both maximum and minimum temperatures were in slight to considerable excess over the greater part of North-West India and to a smaller extent in the south of the Peninsula ; and maximum temperature was below normal in the central parts of the country. Rainfall was lighter than usual in September and temperature was in general excess, the excess being shown chiefly in maximum temperature. During the latter half of the month the excess in maximum temperature was considerable to very large in Rajputana, Gujarat, Khandesh and the Deccan. Unusually high temperature continued in October, November and December, and the excess was shown in both maximum and minimum temperatures over the greater part of the country, especially in North-West India. Unusually fine weather prevailed in November and December in Persia and Baluchistan, and no depressions entered India from the west during these months.

The mean temperature for the whole year was in excess in nearly every division. The variation from the normal was less than 0·5° and hence temperature was practically normal in the Himalayas, the Gangetic Plain, Orissa, the Central Provinces (south) and Berar. The largest excess was shown in Eastern Rajputana and Central India (2°) and the Nerbudda Valley (1·9°). For the whole of India the excess averaged 0·6°.

Pressure varied by only small amounts from the normal during the greater part of the year. In March and September it was, however, in slight to moderate excess in all divisions, the excess for the whole of India averaging about ·045° inch during these two months. Pressure was in slight defect in August and October. For the whole year the variation from the normal was only +·005 inch.

Relative humidity was on the mean of the whole year and for the whole of India slightly below normal. It was in excess in January and February and in general defect from June to the end of the year. August was the only month during this period that showed a slight excess. The largest defect during the monsoon period occurred in Eastern Rajputana, Central India, the Nerbudda Valley and Chota Nagpur ; and during November and December in the Nerbudda Valley, the Central Provinces (south) and Berar. The excess in January and February was most marked in Chota Nagpur, East Rajputana, Central India, the Gangetic Plain and the Punjab Plains.

Cloud was in moderate excess on the mean of the whole country in January, February and April and in moderate defect in June and September. It was considerably below the normal in North-West and Central India during the months of June and September.

The rainfall of the whole year was in defect in all divisions except Lower Bengal, Malabar and Ghats, the Carnatic, Pegu and Tenasserim. On the mean of the whole area the annual rainfall was 3·92 inches in defect, or excluding Burma, 4·13 inches. In 1900 the defect for India, excluding Burma, was 0·57 inch and in 1899 11·14 inches. The largest defect in the annual rainfall of 1901 occurred in Gujarat (17·82 inches) and East Rajputana (12·24 inches).

The rainfall of January and February was in general excess except in East Bengal, Assam, Gujarat, Sind and Cutch. During the hot weather months less rain than usual

was received in nearly all divisions, the defect being most marked in East Bengal, Assam, and the Eastern Himalayas. Rainfall was heavier than usual in a few divisions, the excess being largest in the North Deccan and the Nilgiris. During the monsoon period of June to October rainfall was again in general defect, the only parts of the country where rain in excess of the normal was received being Tenasserim, Arakan, Assam and East Bengal, and the Nilgiris. The north-east monsoon rains during November and December in South India were generally heavier than usual, the largest excess occurring in Malabar and Ghats. Rainfall during these two months was also heavier than usual in Assam and East Bengal, Lower Bengal, Eastern Himalayas, Orissa and the Northern Circars.

European Troops.

Sickness and Mortality in 1901.—The health of the European army of India was better than in the previous year, though the invaliding ratio was greater.

Years.	Average Strength.*	Ratio per 1,000 of Strength.				
		Admissions into Hospital.	Constantly Sick.	Deaths.	Invaliding.	Total Loss.
1896–1900... ...	66,974	1,339	86	17·08	33	50
1900	60,553	1,143	72	14·62	33	48
1901	60,838	1,104	67	12·38	39	51
1891–1900... ...	68,224	1,399	87	16·21	29	45

*The quinquennial and decennial ratios are, of course, worked on the total strength of the lustrum and decade respectively.

The chief causes of admission were ague and venereal disease. Among the diseases with increased admission rates were influenza and respiratory diseases. On the other hand, the admission rates from cholera, small-pox, remittent fever, enteric fever, ague, dysentery, and venereal disease were lessened. Ague and venereal diseases caused respectively 27 and 25 per cent. of the total sickness.

The chief causes of death were enteric fever and abscess of the liver. Among the diseases with increased mortality were circulatory diseases, respiratory diseases, and dysentery. On the other hand, the mortality from cholera, diarrhœa, ague, enteric fever, remittent fever, hepatic abscess, and tubercle of the lungs was lessened. Enteric fever caused 27 per cent. of the total deaths, and hepatic abscess 11 per cent.

The chief causes of invaliding were, in order, ague, secondary syphilis, debility.

The chief causes of admission in the China Expeditionary Force was venereal disease, of which 56 per cent. was gonorrhœa.

Commands and Stations.—Madras was the most unhealthy of the four commands, Bombay coming closely next, and both being less unhealthy than in 1900. Bengal had the highest mortality from cholera, small-pox, remittent fever, dysentery, diarrhœa, and hepatic abscess ; Punjab the highest from enteric fever, ague, heatstroke, tubercle of the lungs, and pneumonia. The highest death-rates among stations of over 100 strength were those of Barrackpore, Deesa, Ahmedabad, Murree, Naini Tal, and Poonamallee, the three last being depôts for men sick or convalescent. All had higher death ratios than in the previous year. Dysentery was the chief factor at Barrackpore, and fevers at Deesa. The highest death-rates in stations of over 1,000 strength were at Ferozepore and Umballa, enteric fever being the chief cause in both cases. The ratio of Ferozepore was somewhat lower than in 1900, that of Umballa considerably higher.

Ratios of Commands.

	Ratios per 1,000 of the Average Strength.				
	Bengal Command.	Punjab Command.	Madras Command.	Bombay Command.	India.
I.—Strength	19,000	16,431	10,282	15,125	60,838
II.—Constantly-Sick-Rate of the Year*	62·3	62·9	79·0	68·8	66·9
III.—Admission-Rate of the Year—					
Influenza	7·3	9·4	12·8	7·6	8·9
Cholera...	·4	—	·2	·2	·2
Small-pox	·4	·2	·5	·3	·3
Enteric fever	13·3	12·6	6·4	16·6	12·8
Intermittent fever	223·8	339·3	308·6	319·7	293·2
Remittent fever	3·5	8·2	5·7	8·0	6·3
Simple continued fever	21·9	17·2	28·6	32·7	24·4
Tubercle of the lungs	2·9	2·8	3·6	4·5	3·4
Pneumonia	3·2	5·2	3·1	4·2	4·0
Other respiratory diseases	23·1	28·8	27·3	23·7	25·5
Dysentery	25·6	14·7	26·2	19·6	21·3
Diarrhœa	14·7	18·7	2·4	14·3	13·6
Hepatic abscess	3·3	1·8	2·6	2·3	2·5
„ congestion and inflammation	16·6	12·0	22·9	15·9	16·3
Venereal diseases	258·8	229·1	372·8	282·6	276·0
All Causes	979·5	1,098·5	1,278·1	1,149·0	1,104·3
IV.—Death-Rate of the Year—					
Cholera...	·37	—	·19	·20	·20
Small-pox	·16	—	—	—	·05
Enteric fever	2·58	4·99	1·75	3·50	3·32
Intermittent fever	·37	·49	·29	·26	·36
Remittent fever	·21	·12	·10	·13	·15
Simple continued fever	—	—	—	·26	·07
Heatstroke	·63	·79	·29	·60	·61
Circulatory diseases	·63	·55	·58	1·65	·85
Tubercle of the lungs	·47	·67	·19	·40	·46
Pneumonia	·37	1·03	·49	·33	·56
Other respiratory diseases	·11	·12	—	·20	·12
Dysentery	1·47	1·10	·19	·73	·97
Diarrhœa	·05	—	—	—	·02
Hepatic abscess	1·79	·85	1·56	1·26	1·36
All Causes	12·95	12·90	9·34	13·16	12·38

* Worked on the aggregates.

Geographical Groups.—The most unhealthy geographical groups in 1901 were Burma Inland and Bengal-Orissa, the latter being also more unhealthy than in 1900. Burma coast had the highest admission ratios from influenza and venereal diseases ; Burma Inland the highest from ague and pneumonia ; Bengal-Orissa the highest from tubercle of the lungs, dysentery, and abscess of the liver ; Indus Valley the highest from small-pox ; Central India the highest from enteric fever, remittent fever, and diarrhœa ; Southern India the highest from simple continued fever ; and the Hill Stations the lowest from ague and venereal disease. The only point in which the decennial relations, described in last report, correspond with the above is the supreme height of the dysentery admission ratio in Bengal-Orissa.

Ratios of Geographical Groups.

	Ratios per 1,000 of the Average Strength.												
	I.	II.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII*a*.	XII*b*.	
——	Burma Coast and Bay Islands.	Burma Inland.	Bengal and Orissa.	Gangetic Plain and Chutia Nagpur.	Upper Sub-Himalaya.	North-Western Frontier, Indus Valley, and North-Western Rajputana.	South-Eastern Rajputana, Central India and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	Hill Convalescent Depôts and Sanitaria.	India.
I.—Strength	1,049	1,906	2,025	6,160	11,045	4,458	5,442	8,630	1,552	2,662	8,692	3,184	60,838
II.—Constantly-Sick-Rate of the Year*	96·9	96·9	74·9	57·9	69·3	61·5	84·5	79·4	53·6	58·7	49·3	81·4	66·9
III.—Admission-Rate of the Year:													
Influenza	59·1	—	1·5	5·7	4·4	13·5	9·9	8·1	2·6	6·0	13·6	20 1	8·9
Cholera	—	—	—	·8	—	—	·4	·3	—	·8	—	—	·2
Small-pox	1·0	—	1·0	·2	—	1·1	·2	1·0	—	—	—	—	·3
Enteric fever	—	4·2	7·4	11·0	14·0	11·7	25·4	17·0	·6	3·8	12·0	10·4	12·8
Intermittent fever	225·0	796·4	248·4	229·4	395·7	288·9	461·4	220·7	206·8	127·7	122·9	434·7	293·2
Remittent fever	—	9·4	15·3	1·9	6·9	8·1	19·7	2·9	3·9	7·1	3·2	3·5	6·3
Simple continued fever ..	7·6	—	4·0	37·8	7·8	54·1	42·8	41·1	12·2	80·0	3·2	10·1	24·4
Rheumatic fever	1·0	1·0	—	·2	·5	·2	·9	1·2	—	·4	1·2	2·5	·8
Tubercle of the lungs ..	4·8	3·1	5·4	2·6	3·9	1·6	3·7	1·6	·6	3·4	1·2	4·7	3·4
Pneumonia	1·0	6·8	2·0	2·8	5·2	3·8	2·8	2·3	3·2	1·1	6·3	4·7	4·0
Other respiratory diseases	31·5	25·7	17·3	23·4	28·5	21·5	26·6	21·4	24·5	20·3	26·5	43·0	25·5
Dysentery	44·8	28·9	85·9	19·3	18·7	9·4	23·2	22·2	13·5	20·7	12·5	17·9	21·3
Diarrhœa	1·0	3·7	19·3	14·0	19·0	12·1	23·2	8·2	1·3	3·4	14·6	17·9	13·6
Hepatic { abscess	2·9	4·7	9·9	3·4	2·3	·4	1·8	1·7	4·5	1·1	1·5	4·7	2·5
Hepatic { congestion and inflammation.	16·2	22·6	33·6	14·9	9·8	10·1	18·9	18·0	20·0	17·3	12·1	36·7	16·3
Venereal diseases	476·6	295·9	370·9	219·6	253·0	227·9	313·1	408·9	216·5	329·1	212·8	208·9	276·0
All Causes	1,272·6	1,671·6	1,139·3	937·7	1,178·8	1,041·0	1,412·0	1,202·5	851·2	1,062·7	780·9	1,303·4	1,104·3
IV.—Death-Rate of the Year—													
Cholera	—	—	—	·81	—	—	·37	·35	—	·75	—	—	·20
Small-pox	—	—	·49	—	—	—	—	·23	—	—	—	—	·05
Enteric fever	—	2·10	2·96	1·95	4·44	4·93	4·96	3·71	—	1·13	3·57	3·45	3·32
Intermittent fever	—	1·57	1·98	·32	·63	—	·37	—	—	—	—	·63	·36
Remittent fever	—	—	·49	·16	·18	·22	·18	—	—	—	—	·63	·15
Simple continued fever ..	—	—	—	—	—	—	·74	—	—	—	—	—	·07
Heatstroke	·95	·52	·49	·97	1·00	1·12	·92	·12	—	·38	—	—	·61
Circulatory diseases ..	—	1·05	·99	·97	·54	·22	·92	1·39	1·93	·38	1·04	·31	·85
Tubercle of the lungs ..	—	—	1·48	·81	·81	—	·55	·12	—	—	·12	·63	·46
Pneumonia	—	1·05	—	·32	1·00	·90	·55	·46	·64	·38	·69	—	·56
Other respiratory diseases	—	—	·49	—	·18	—	·37	·12	—	—	—	—	·12
Dysentery	·95	—	5·43	1·30	1·72	·45	1·10	·23	—	—	·81	·63	·97
Diarrhœa	—	—	—	—	·09	—	—	—	—	—	—	—	·02
Hepatic Abscess	·95	2·62	4·94	2·11	·91	—	1·30	1·51	1·29	·75	·92	2·83	1·36
All Causes	7·63	13·12	23·70	13·31	14·67	10·09	16·72	11·94	5·15	6·39	8·63	13·51	12·38

* Worked on the aggregates.

Influenza.—The absolute and proportional amounts of influenza rose greatly. The admissions began to rise in February, reached their maximum in May, and rose again in December. For the 12 years that the disease has been epidemically present in India the maximum month is April, and the minimum August. As compared with 1900, Group VII was the only fresh one affected ; Group II escaped in both years ; while in both all the other groups recorded admissions. Thirty-three stations returned cases, against twenty-two. The highest numbers were at Rangoon, Nowshera, and Kuldunnah. The disease was generally mild in type, and only one death was returned. It is said to have been severe at Roorkee, and to have caused much debility at Kuldunnah. The researches of Onorato on the resistance of the influenza bacillus to physical and chemical attacks, show, among other things, that under laboratory conditions it is very susceptible to drying and to the action of carbolic acid and some other common disinfectants.

Cholera.—The amount and proportion of cholera was much less than in the previous year, the admissions having fallen from 107 to 12, and at no station were there more than three cases. It is generally mentioned that the disease was present in the neighbouring city or bazaar, but the exact origin does not seem to have been traced in any case. At Poona the two men first attacked were in Ward 1 of the hospital, and the third was attending on the first after he had been removed to another ward.

Small-pox.—The admission rate from small-pox was only a half of what it had been in 1900, but the death-rate remained the same ; the admissions and deaths being 20 and 3 against 36 and 3. Jubbulpore had 3 admissions and 2 deaths, and no station had more. Most of the cases were mild in men who had been vaccinated and revaccinated, or vaccinated and unsuccessfully or inefficiently revaccinated. A confluent form of the disease occurred at Rangoon in the person of a man who had not been vaccinated for 11 years and had not satisfactory marks of protection. At Jubbulpore the men were on duties which brought them into contact with natives ; and the disease was generally present in the city or bazaar.

Ague, remittent fever, simple continued fever, Malta fever.—Ague gave rise to nearly 27 per cent. of the admissions from all causes. Both the admission and the death-rates were lowered. The most malarious month for India was October, but for Burma Inland, which was the most malaricus group, it was November. The most malarious stations were Fort Dufferin, Fcrt Lahore, and Meean Meer ; and then Nasirabad, Ferozepore, and Delhi. The fever at Fort Dufferin is said to have been milder than in 1900, and Mandalay Hill continued to be more healthy than the fort. The malariousness of Fort Lahore is attributed to the lowlying marshy ground on the bank of the river near the fort. Men from Barrackpore and Delhi are said to have increased the ague admissions at Nasirabad ; but in September anopheles was found in swimming baths, garden tanks, gumlahs, drains, pools, ghurrahs. Measures were taken against the anopheles, and quinine was issued prophylactically, but the effect was "not very apparent." Much of the sickness at Ferozepore is said to have been connected with the previous year's outbreak. Fever at Delhi was most abundant at the season when pools had formed in the river bed, and anopheles was frequently found. The use of kerosene is said to have produced no appreciable difference ; but, as far as the report shows, it does not seem to have been carried out with much thoroughness. Meean Meer was examined by the Royal Society's Malaria Commission in December, who found that the bearer of the infection was the *Anopheles culifacies* bred in the numerous irrigation channels, and made suitable recommendations. Many admissions were recurrences, and regiments coming from unhealthy stations raised the numbers in some stations where the disease was not naturally very prevalent. At Peshawar the ague was ascribed to inordinate irrigation ; while at Kirkee the catchpits and unlined drains near barracks, were considered to have been more to blame than the irrigation. At Rawalpindi and Dinapore there were plenty of anopheles breeding pools ; and at Roorkee these mosquitoes were found to be breeding in the fire tanks. No anopheles could be found in No. 2 district at Mhow, though it was present in a village half a mile away ; and the artillery at Fort Syrian suffered much more than the troops in Rangoon itself. At Colaba, where the anopheles is said to be unknown, the garrison artillery had no fever ; but they suffered after going to Middle Ground Fort, where anopheles is frequently found. There is said to have been no local ague at Mount Abu, the rainfall having been 47 inches less ; and anopheles, so common in the previous year, was hardly to be seen. The diminution at Aden was ascribed to the scanty rainfall, to the non-occupation of the isthmus position, and to the greater attention paid to the destruction of anopheles. At Mallapuram patients

had prolonged quinine treatment, and while in hospital used mosquito curtains, hollows were drained and levelled, waste or stagnant water was not allowed to remain in the barracks, and some pools were treated with kerosene. Anopheles larvæ were found at Neemuch in the puddles and hoof marks near the wells, in the tatty and garden tanks, in catchpits and drains, and in the edge water of a nullah, all near the hospital or barracks ; and measures were taken accordingly. Though common in the previous year, anopheles was rare in 1901 ; and it was supposed that the larvæ might have been washed away by the floods in 1900. In Amritsar anopheles was plentiful, but it was difficult to find its breeding places. Pools were drained and filled in at Deesa, covers were provided for the water chatties, and disused wells were kerosened. The stagnant pools of Sialkot were attended to ; one near the military prison was levelled, "and ague cases appear to be now less frequent." At Nowgong great care was given to filling up stagnant pools and holes near barracks, and to removing tins, &c., likely to harbour the larvæ ; and it is said that there are now fewer mosquitoes and less malarial fever among the European troops. Though the prophylactic issue of quinine was probably universal, or nearly so, only sixteen reports mention it. Seven say that the effect was good ; one that the disease was made milder but not prevented ; one that ague held off as long as the quinine was given, but began to occur again within a week after it was stopped ; two that there was no appreciable effect ; and one that in spite of it there was more ague than in the previous year. Probably, if medical officers were keen about the matter, they would say more about it in their reports.

There was also a great decrease in remittent fever. The maximum month, like that of ague, was October ; but there was another maximum in June, to which ague had nothing corresponding. The highest admission ratios were at Mhow, Mount Abu, and Shwebo.

The admission ratio from simple continued fever was the same as in the preceding year. The most frequent causes assigned for the attacks were heat, work in heat, exposure to the sun, errors of diet, chills. Some of the cases are said to have been possibly enteric fever, while others were distinguished from that disease only by the negative result of Widal's reaction or by the sudden permanent fall of the temperature. Two of the cases were thought to have been possibly Malta fever, and in one station dengue was suggested. Benares returned neither simple continued nor enteric fever.

Three cases of Malta fever were returned from Meerut, and one each from Subathu and Poona ; the diagnosis in most, if not in all, being confirmed by the serum reaction. Six cases of accidental infection through minimal inoculation have lately been published by Wright and Windsor as having occurred at Netley ; and they notice also two other similar cases, occurring respectively at Haslar and in the Philippine Islands.

Enteric fever:—*Water and Milk.*—The fact of the frequent connexion between the ingestion of drinking water and enteric fever is acknowledged, and appears to be established ; but the exact relation of the water to the morbific agent is still involved in obscurity. From an examination of the records of 638 epidemics and 12 single cases, contained in the literature of 14 countries of the world, Schüder found that 70 per cent. had been referred to water, only 17 per cent. to milk, and the still lower per cent. of from 0·2 to 3·5 to other causes ; and concludes that the cause of the disease must be combated in the first place in water, and that when that has been done, the greater part will have been done. Corfield, too, in his Milroy lectures, has collected from all parts the powerful evidence which points to water as the chief vehicle of the infection. Yet it has been found more difficult than ever to recover the specific microbe from suspected water, the progress of knowledge having led investigators to be less easily satisfied in the matter of identification. In fact, Sims Woodhead, agreeing with others as to the difficulty of finding the bacillus in water, states that he has never succeeded in isolating it therefrom, except when he had previously placed it there himself. It has been pointed out that unless the specific pollution is continuous, it is extremely unlikely that enteric bacilli will be detected in a water if more than a week has elapsed since the actual pollution occurred. As the incubation time of enteric fever is usually over a week, the bacillus will have vanished by the time suspicion is thrown upon the water by the occurrence of cases. In all cases it is necessary to examine a considerable quantity of the water, and that the examination should be systematic and periodic, "the variations in the composition and flora being the surest signposts of danger." Another explanation which has been thought of is that the enteric bacillus may change its typical characters when

living in water. Hence the attention which is directed to the enteric-like bacilli of water, as distinguished from those of more frankly colonic character. Thus Vaughan believes that a water containing the colon bacillus alone does not cause enteric fever, and that the more enteric-like the germ is, the more likely is the water containing it to cause enteric fever; and he has no hesitation in condemning waters which contain enteric-like bacilli. He is one of those who have never succeeded in finding in any sample of water a typical enteric bacillus, and who do not believe that it preserves its typical characters for any length of time when growing in water. Some observers from actual practice have reported that it is not safe to trust alone to the method of von Drigalski and Conradi, which consists of cultural separation in a special medium, and then confirmation by a highly diluted enteric serum; but that the colonies apparently identified as enteric must be submitted in addition to all the usual tests. It is frequent in India as elsewhere to find in water bacilli which, while giving all the cultural reactions of the enteric bacillus, refuse to be aglutinated by enteric serum. With regard to such Bancel suggests that in order to be able to pronounce on their nature the observer should make a series of cultures, and see whether they do not sooner or later become agglutinable; and points out that enteric bacilli from blood, pus, &c., are only slightly agglutinable, but become more so by cultivation on artificial media. From his suggestion that the agglutinability may vary inversely to the virulence it follows that such an enteric-like bacillus of water, which possesses all the classical characters of the enteric bacillus except its agglutinability, may in reality be the true bacillus in its most virulent form. On the other hand, it must be remembered that, according to present knowledge, clinical enteric fever may be caused by more than one bacillus, that more than one disease is included under the clinical name "enteric fever," a fact which explains some of the clinical failures of Widal's test. And Sion and Negel have actually described an outbreak of waterborne enteric-like fever caused by a non-Eberthian bacillus. Neumann enunciates a peculiar hypothesis, that drinking water does not convey the bacillus, but certain fluid bodies which enable the enteric-like bacilli, everywhere present, sometimes inside the body as well as outside, to become true enteric bacilli. Sims Woodhead believes that with our present methods more is to be gained by a general bacteriological examination than by an examination for any special species, and lays far more stress on the departure of water from its normal bacteriological standard than on the appearance of any special set of organisms, though the appearance of any fresh set of organisms is, of course, a definite indication that the water is departing from its normal bacteriological standard. After all, even if the enteric bacillus itself cannot be found in a suspected water, it is sufficient, as Houston among others points out, to show that microbes indubitably of intestinal origin are present in a water, to condemn it; because they are apt, of course, to be accompanied by pathogenic germs. Here again doubt has arisen as to which germs are of indubitable intestinal origin. Some like Chick have minimized the distribution of the *Bacillus coli*, for example, while others find it everywhere; and this disagreement seems to depend upon a difference of opinion as to what is and what is not a *Bacillus coli communis*. There is, however, a general agreement that the number and not the mere presence is to be regarded, that the source which supplies the colon bacillus to the water should be searched for, and that special suspicion should attach to a varying content. Pakes stated in 1900 that water which contained *B. coli* in 20 cc. or less should be condemned, that if the *B. coli* were only present in from 50 to 100 cc. the water should be looked upon as slightly suspicious, and that if that bacillus were only present in greater quantities than 100 cc. the water was probably safe. Horrocks considers that water which contains *B coli* so sparsely that 200 cc. have to be tested to find it, is probably polluted with sewage, but the contamination is not of recent date. Houston finds that streptococci are absent from 10 cc. (or more); *B. coli* from 1, 10, it may be 100 cc. (or more); and *B. enteritidis sporogenes* from 100 to 500 cc. (or more) of pure waters: that is, these microbes are altogether absent or relatively so from pure waters; that the presence of streptococci is to be thought of as indicating extremely recent, and of *B. coli* less recent but still not remote pollution of animal sort, but that the presence of *B enteritidis sporogenes* cannot be considered to afford evidence of pollution bearing a necessary relation to the recent evacuations of animals; that the presence of streptococci in any number in a water-supply points not only to recent animal pollution, but also implies that the antecedent condition—conditions intervening between the period of pollution of the water and the time of collection of the sample—could hardly have been of so unfavourable a character as to destroy the vitality of seemingly more hardy microbes—for example, the enteric bacillus, though quite the same cannot be said for the *B. coli*, since *B. coli* is a more hardy germ than *B. typhosus*. Firth is of opinion that the

presence together of streptococcus and *B. coli* is an indication that the water has recently been contaminated by sewage and is unfit for use. Chick's experiments led her to believe that the colon bacillus is much less ubiquitous than has been supposed and that its presence indicates recent pollution. On the other hand, Papasotirin who has found *B. coli* in dough and in various unground cereals and pulses, considers that the presence of some colon bacilli in water is of no significance, but that a great abundance makes one think of contamination by fæcal matter; though it may also be connected with the putrefaction of vegetable matter. Irons cautions against trusting to neutral red for the detection of the colon bacillus in water, since the reaction is given under the conditions of the test by a number of other water organisms which no classification however liberal would place in the colon group. The propriety of judging different kinds of water by different standards is insisted on by Savage, allowance being made for an upland surface water, for example, as compared with a spring water. Waters which show no colon bacilli in 50 cc. are, according to him, of a high degree of purity. Some, like Meusburger and Rambousek, are content to have as sole criterion the colon bacillus as such; but Horrocks, as quoted in last report, has endeavoured to distinguish colon bacilli derived from a case of enteric fever from colon bacilli of ordinary provenance. The technique employed by Horrocks is, however, considered by C. Fränkel to be not quite beyond reproach. In the United States, in river water considered on inspection to be unpolluted, Smith and Brown found the numbers of colon bacilli to vary between 9 and 5 per cc.; and Jordan remarks that as there are no methods in common use that are universally applicable to their direct detection, the fate of typhoid germs introduced into a stream or lake must be determined by inference; and that the best index we can secure at present for gauging the probable continuance of vitality of the enteric bacillus in running water is the information derived from the fate of the colon bacillus. Aldridge, after remarking that the vitality of *B. typhosus* in water is not great, and that when enteric fever is almost continuously present there must be repeated infections from fæces or urine, which can hardly be conceived toaffect well-protected pipe supplies, goes on to say that in combating enteric fever in tropical places it is not sufficient to obtain a water pure at its source, nor even to purify a doubtful water, but that the chances of its contamination are as great—in many cases greater—as at its source. Caink found that the enteric fever rates in towns supplied with filtered river water were much lower, generally speaking, than those in towns supplied from artesian wells and mountains. The somewhat similar results of Saltet in Holland are discussed by Corfield in his Milroy lectures. In the sanitary history of cities, says Osler, it has been amply demonstrated that an abundant and good water-supply, though of the first importance, is not enough to reduce the death-rate from typhoid fever to a minimum. He gives instances where the high death-rate from the fever persisted after the introduction of a good water-supply until a sewage system had also been introduced. In America, as in India, instances have been noticed where troops using the same water-supply as the civilian population suffered from enteric fever, while the latter escaped entirely or almost entirely. Schüder has shown that the bromine process of Schumburg, so much praised at one time, is practically useless for the sterilization of water, as regards the germs of cholera and enteric fever; and Engels from his experiments concludes that of all the chemical means of water sterilization hitherto invented, with the possible exception of ozone, not one is really trustworthy. The practical use of ozone in the treatment of drinking water has been studied by Ohlmüller and Prall, who found that it gave a better general result than sand filtration, and that the cholera and enteric fever bacteria were destroyed. Schüder and Proskauer in a still more recent research formed a favourable opinion of ozone, but pointed out imperfections in the methods of Ohlmüller and Prall. The danger of trusting to aërated waters as safe, especially in times of epidemic enteric fever, has been emphasized by Chantemesse and others, as the bacilli retain their vitality in such waters for days and even weeks. A résumé of knowledge as to outbreaks caused by milk, and of the behaviour of the enteric bacillus in milk, has lately been given by Corfield. Osler remarks that one or two typhoid bacilli in a glass of water may be, probably often are, taken with impunity by an individual not specially susceptible, but a few in water used to rinse a milk can or jug would find in the milk such a suitable medium for growth that in twenty-four hours the food would be highly infective. So also Fulton shows that milk infection means large dosage and greater percentage of attacks. Schüder speaks of milk as a very dangerous spreader of the infection, because it is a good nutrient medium for the bacillus, and because infected milk is apt to be delivered to a large number of households. It is stated that enteric bacilli retain their vitality in boiled milk for as long as three months or more.

Soil. Dust. Flies. Clothes.—No single fact, says Osler, has been more clearly brought out than the intimate association between sewage polluted soil and typhoid fever: wholesome healthy water is not alone sufficient to abolish the disease; but healing of the sickness in the soil, purifying it by proper drainage, is at once followed by a remarkable fall in the death-rate from typhoid fever: this has been strikingly shown in many cities: the local conditions permitting the disease to be endemic throughout the year relate unquestionably to the persistent pollution of the soil: the presence of typhoid fever in a city means bad drainage, or polluted water-supply, or both. With regard to the cases from time to time reported of the occurrence of outbreaks of the fever on the so-called virgin soil of remote uninhabited places, Munson suspects that the soldiers carried the infection with them in their own bodies (excreting it in their urine), on blankets, &c. Some of the most important instances of the connexion of enteric fever with soil infection have been recently collected by Corfield; and Schüder in treating of the same subject, points out the danger of soldiers and workmen, who have to clean their own boots and often eat without washing their hands, of the infected earth which adheres to the boots. The general result of Sidney Martin's late researches was to show that the enteric bacillus has commonly only a short existence in the soil, and that it is destroyed by the products of the putrefactive bacteria which exists in most cultivated soils. As Houston says, the general tendency is for the more hardy soil bacteria to oust the sewage microbes in the struggle for existence: *B. coli* and allied forms introduced with the sewage become greatly reduced in numbers, and their presence in a soil in any considerable amount is taken as suggesting pollution of comparatively recent date, the presence of streptococci in soil is another good indication of of sewage contamination, and, as these organisms dissappear very rapidly, of its extremely recent occurrence. E. Pfuhl found the enteric bacillus to survive close under the surface of damp garden earth for 88 days, in loose pretty dry sand for 28 days. The observations on this point of many observers are summarized by Gotschlich. The experiments of Firth and Horrocks showed them among other things that there is no evidence to prove that the enteric baccillus when placed in soil displays any disposition or ability to increase in numbers or grow upwards, downwards, or laterally; that it is able to asume a vegetative existence in ordinary and sewage polluted soil and survive therein for varying periods amounting in some cases to as much as 74 days; and that an excess or deficiency of moisture in soils appears to be the dominant factor affecting the chances of survival of the enteric bacillus, or at least the possibility of recovering it. The moral which V. Poore draws from their experiments is that care and attention make the practice of burying excreta in the earth practically safe, the cultivation and cropping of the land being duly regarded as part of the process. Munson thinks the dry earth system likely to aid in the spread of enteric fever; and that, though the bacillus is destroyed by dessication in a short time, it may long retain its vitality in relatively dry material, and find in dust and wind an excellent vehicle for its diffusion. To show that some of the dust carried by the wind actually does come from the latrines, Powell records having had to abandon dinner on the veld, owing to a dust spout, which had first passed over the trenches, covering the food with dust and toilet paper; and remarks that many a time food must have been eaten covered with dust from the same quarter, when there was no telltale paper to betray its origin. So Osler mentions the danger of dust sweepings from unwatered streets reaching uncovered milkpans. Munson mentions that Tryde and Salomonsen found enteric bacilli on the floors of a barrack in Copenhagen, Uptadel at Augsburg, Birch-Hirschfield at Leipsig, Chour at Jitomir. On the other hand, the opinion given in Nothnagel's Encyclopedia is that the dissemination of the enteric bacillus in the dry state, attached to particles of dust, through the air is possible, but not common. Firth and Horrocks found that from an ordinary soil allowed after inoculation with the bacillus to become so dry as to be readily blown about as dust, the enteric bacillus can be recovered up to and on the twenty-fifth day; and that enteric infective material can be readily translated from dried soil and sand by means of winds and air currents. The same experimenters found that the ordinary house fly can convey enteric infective material from specific excreta or other polluted material to objects on which they may walk, rest, or feed; but that it has not been proved that the enteric bacillus passes through the digestive tract of the fly. During three years in the United States, Howard and his assistants made a collection of all the insects found on or breeding in human fæces; 44 beetles, a number of hymenoptera, and 77 flies. In kitchens during two summers they caught 23,087 flies, of which 98·8 per cent. were *Musca domestica* and 1·2 per cent. of various other kinds, but none of the kinds which are most frequently found on human fæces. Howard, however, points out that though the common fly usually deposits its eggs in horse dung, it frequently lays them in human fæces; so that it is dangerous to

have human fæces in the neighbourhood of kitchens and dining rooms. Corfield and others give instances of infection contracted from soiled clothes, or warn against the danger ; but Collie brings forward examples of the greater danger undergone in visiting a patient than in washing his clothes. On pieces of uniform cloth soiled with emulsion of the enteric bacillus Firth and Horrocks found the bacillus capable of detection up to from 74 to 87 days ; and on uniform cloth soiled by enteric fæces up to from 9 to 17 days.

Enteric fever—direct infection.—That enteric fever is frequently communicated by personal intercourse is an opinion which has steadily been gaining ground of late years. This was found to be an important factor in the causation of the fever in the American military camps ; and in a German official military report it is stated that in enteric fever the conveyance from man to man, from patient to attendant, plays a not unimportant part. Corfield and also Munson point out that the incidence of the disease to strength is higher among attendants than among patients in the hospital or soldiers in general. Statistics for nurses are given in Nothnagel's Encyclopedia, though it is expressly pointed out that the disease is not contagious in the old sense of the term. In the Prussian army in 1897–98, 30 attendants and 11 patients in hospital for other diseases were attacked ; and Schüder speaks of 35,647 cases of enteric fever with 1,179 cases among their attendants. Eschricht gives a series of five cases, in which each successive person attacked had been attending on the one before ; and Krieger reporting on the work of Koch's enteric fever commission mentions that direct infection was found to be more common than had been supposed, and to be the chief means by which the disease was spread. Finally, of some importance are the laboratory cases of Fürnrohr and of Klinger. Fürnrohr fell ill three weeks after making an enteric post-mortem examination, and was supposed to have become infected through splashing in cleaning the intestine, or from not having succeeded in cleansing his hands thoroughly. During an experiment an accident caused infective material to splash up into the faces of Klinger and his assistant, and both were in due course attacked by the disease. It has long been known or suspected that the disease may be infectious in the incubation stage, that it is spread greatly by mild cases not diagnosed, and even that the evacuations of healthy people who have been in contact with the sick may contain the bacillus. Hurd speaks of a case in which the fever was moderate and lasted only 10 days, so that the disease was supposed to be a febricula ; but the Widal test was applied from time to time, and at last after 40 days the reaction became positive. In Alsace–Lorraine Koch's enteric fever commission have found the von Drigalski and Conradi medium combined with an improved agglutination procedure of great use in discovering mild unsuspected cases. Thus, in one place 73 cases were found where only 10–12 had been reported, and 53 of these were children under 16 years of age.

Enteric fever — the bacillus.— Courmont, in an article containing a résumé of previous work on the subject, records the finding of the bacillus in all of the nine cases which came under his observation in 1901, but does not venture to affirm that it would be found in mild or abortive cases. He found the bacillus as early as the fifth day, and in four cases before the Widal reaction could be obtained, and up to the end of the third week. The bacilli when recovered from the blood are generally but little agglutinable, but can be made more agglutinable by cultivation. There was no definite relation between their presence and the agglutinating power of the blood, which might be weak or negative. His results are confirmed by Busquet. Licht had positive results in 11 of 14 cases, Haslett in 17 of 24, and Menzer in one case. Haslett did not find the bacillus before the third or fourth day, but in three instances before the serum reaction was established. In two mild cases he found it on the 11th day. Schottmüller isolated it in 98 of 119, once on the second day ; Cole in 43 of 58. Widenmann recovered it from the roseola in 5 of 7 cases ; Seemann in 32 out of 34, in 8 before the serum reaction could be obtained. The total result of these and other observations is that the bacillus is discoverable in the blood in from 70 to 80 per cent. of cases. From a study of the literature, Schüder found that 19 observers had detected the enteric bacillus 177 times in the urine of 599 patients, 29·55 per cent. ; and he himself isolated it in 5 out of 22, 22·2 per cent. ; so that on the whole it may be said that it is to be discovered in between one-fourth and one-third of cases. Büsing records an interesting case of a soldier from China who went on giving out enteric bacilli in his urine for four months after he appeared to be in robust health. Urotropine was successful in clearing the urine, but the man was detained for a month more in hospital under constant observation before he was discharged cured. As an effective disinfectant for the voided urine Gwyn recommends the addition to it of one-fifth its volume of 1–1000 perchloride of mercury solution. By their new method von

Drigalski and Conradi succeeded in demonstrating the presence of enteric bacilli in the stools of patients at various stages of the disease, and in more than half the cases at a period when the Widal reaction was not yet established. Remembering Koch's positive results with the cholera comma, and his remarks on the importance of the matter, they examined the stools of apparently healthy persons who had shared the rooms of patients, and in the apparently normal stools of four of them found the enteric bacillus. Dieudonné isolated the enteric bacillus from the red sputum of a patient ill with enteric pneumonia. It remained present in the sputum far into convalescence and when the patient felt quite well, seven weeks after admission ; and he points out the importance of this feature, in which enteric pneumonia resembles plague pneumonia, for the spread of the disease. He and also Schüder quote previous similar observations by von Stühlern and by Edel, and two cases have quite recently been added by Glaser. Munson states that positive results have been obtained by Williams and others. In the course of an article on the gallblader complications of typhoid fever, Camac remarks that it is no longer a question of where the typhoid bacilli may be found, but where they may not be found in the body after infection; and Flexner gives a list of the various situations in which they may be found. Full details as to the work hitherto accomplished in the detection of the bacillus in the human body and its various excretions have lately been collected and published by Burdach.

Besides his earth results, already referred to, E. Pfuhl found the enteric bacillus to survive on linen 97 days, in iced water 26 days, in Seltzerwater 15 to 27 days, in milk 11 to 13 days, in butter and Gervais cheese 24 days. Firth and Horrocks report that the enteric bacillus is able to survive in surface soil an exposure to 122 hours of direct English sunshine extending over a period of 21 consecutive days ; and that from a piece of infected serge it is recoverable after the fabric has been exposed to 50 hours of direct English sunshine spread over a period of 10 days. According to MacConkey, not only is the enteric microbe unable to multiply in crude sewage and sewage effluents, but its presence can no longer be demonstrated therein after the lapse of 6–17 days. In cereal products Klein and Houston observed no tendency on the part of the enteric bacillus to multiply. Sedgwick and Winslow and also Brehme, experimenting with cold, found that there were always apt to be some survivors, even when the majority had been killed. Valentini concludes from his experiments that not only in human surroundings but in human bodies there exist enteric-like bacilli, which are usually harmless to the individual that shelters them, but under certain circumstances can acquire characters which make it impossible to differentiate them from true enteric bacilli, even by the serum reaction.

Enteric Fever without intestinal lesions. Non-Eberthian Fever (*Paratyphoid*).—From the rapid growth of the literature bearing upon non-intestinal forms of enteric fever Flexner judges that typhoid septicaemias will come to be regarded as by no means among the rarest manifestations of the disease. But at the same time the progress of bacteriological diagnosis has revealed the fact that a considerable number of cases which present the clinical picture of enteric fever are really caused by bacilli which are only enteric-like, not Eberthian ; and A. Fränkel might have gone further when he expressed his opinion that the belief in the unity of enteric fever is threatened, and that it looks as if from the bulk of so-called enteric fever at least one group would emerge, which is etiologically different from the majority. Others have expressed themselves in somewhat similar terms, and suggestions have appeared for the systematic searching out and study of such cases. Blumenthal has met with a fresh case of enteric fever in which there were no intestinal lesions, although Widal's reaction was positive and the bacillus was cultivated from the spleen and lymph glands. A case of enteric-like fever caused by a bacillus which appeared to be that of Gärtner has been brought forward by Craig and White. Johnston has published four cases of paratyphoid fever, with an analysis of all recorded cases, which shows that the gravity and mortality are less than in true enteric fever, and that there is an absence of intestinal ulceration. Such cases may also appear during enteric fever epidemics, but it is not justifiable to call all enteric-like cases in which the Widal reaction is negative, "paratyphoid," because the reaction sometimes fails in genuine enteric fever. For example, Hoffmann collects 178 cases of negative Widal reaction, and in eight of these the enteric bacillus was found. In two of Johnston's own cases a paratyphoid bacillus was cultivated from the blood, and in the other two the identification was effected by agglutination of Gwyn's bacillus or of the bacillus got from the first two cases. Widal's reaction was negative in all. Petruschky had a case in which the *B. alcaligenes* was isolated from the roseola, and has convinced himself that the colon bacillus, the *B. alcaligenes*, and perhaps others, may produce an infection very typhoid-like. An interesting waterbourne house epidemic was observed by Sion and Negel, in which the

symptoms were those of enteric fever. Two of the patients were a man and his sister, both of whom exhibited the Widal reaction. During life a bacillus was cultivated from the blood of the man, which proved to be neither the enteric bacillus nor a typical colon bacillus ; and after death there were found no intestinal lesions. In a military epidemic at Saarbrücken, reported by Hünermann, a bacillus belonging between the enteric and the colon bacilli was isolated from the stools and urine by means of von Drigalski and Conradi's method, and in most of the cases Widal's reaction was negative. The occurrence of cases clinically enteric fever, but not caused by the bacillus of Eberth, of course explains some of the negative results of Widal's reaction which have been reported as obtained in enteric fever ; and so far, as Gwyn points out, it enhances the value of the reaction.

Enteric fever—Incubation, &c.—In the case of Fürnrohr, referred to under direct infection, the period of incubation was three weeks ; in that of Klinger three weeks, and in that of his assistant, apparently infected at the same time, about five weeks. Palmer found that the incubation period of certain cases was five days. Corfield describes an outbreak in which Buchanan was able to fix the incubation time as 11 days. The experience of Timann has been that the roseola appears with great regularity from the twenty-first day after infection. In Nothnagel's Encyclopedia the incubation is stated to be usually one, two or three weeks, but sometimes longer. At Coblenz in a military outbreak Rieder fixed the time at 14 to 16 days in 80 per cent. of the cases. From an elaborate paper by Fulton, containing both his own experiences and those of others, it may be gathered that the limits observed were from 9 to 28 days ; except in the case of a child who drank infected milk only once, on the afternoon of the 19th July, and fell sick on the 24th, youth and a massive dosage causing shortening of the incubation time. In his account of a case in which there were three relapses, Warfield professes himself inclined to agree with Durham in looking upon the varying preponderance of varietal forms as explanatory of relapses. We are, says Osler, still really without full knowledge of the causes of relapse, but the frequent occurrence is a positive indication that immunity in typhoid fever is slowly acquired, and not reached at the period of apyrexia. In South Africa about 4·5 per cent. or more of Elliot and Washbourn's cases had had a previous attack, and one man died in his third. The highest percentage quoted in Nothnagel's Encyclopedia is that of Eichhorst, 4·2 (28 in 666), and he had observed cases in which there had been three and even four attacks.

Enteric fever in association with other diseases.—Finding that in a certain number of cases in South Africa already in hospital for dysentery enteric fever developed, Rolleston concluded that the diseases had been contracted together, but that the incubation time of enteric fever is greater than that of dysentery. In the same country Elliot and Washbourn observed 21 cases of enteric fever associated with dysentery in the attack, or shortly before or after ; and Morris noted that as many seemed to have the dysentery after as before the enteric fever. The bacillus of Shiga seems to be a near relation of that of Eberth. Osler states that Da Costa has collected 22 cases in which the association of abscess of the liver with typhoid fever seemed beyond doubt : that the Munich statistics of 2,000 enteric fever post-mortems give 12 ; that these Munich statistics perhaps include those of Dopfer, who found 10 in 927 ; and that abscess of the liver is also sometimes secondary to the complications of enteric fever, such as bone disease, laryngeal perichondritis, &c. Lyon gives notes of 30 cases of true combined typhoid and malarial infections, and refers critically to other reported cases ; and Osler in Nothnagel's Encyclopedia reports only three out of 1,100 cases of enteric fever treated in the Johns Hopkins Hospital. But in such countries as India similar cases may probably be common. By Fiocca is published a case in which the haemamoeba was present in the blood before the onset of the enteric fever, during the interval between the original fever and the relapse, and after the relapse had subsided, but not while the enteric fever was actually in course.

Enteric fever—susceptibility and conducive causes.—The board which investigated the outbreaks of enteric fever in the American army during the war with Spain believed that from one-fourth to one-third of the individuals in a regiment were susceptible. Munson and also McCulloch have each treated of the greater incidence of enteric fever among cavalry men than among men of infantry regiments. The latter surmises that possibly the unsterilized water used may contain enteric bacilli, which passing through the horses' bodies may contaminate the ground and litter, and also that the men are in the way of temptation to drink the impure water. Corfield states that overcrowding appears to have less influence on the spread of enteric fever than of any of

the other contagious fevers, owing to the fact that the disease appears to be less directly spread from person to person. But the opinion is gaining ground that personal infection and therefore overcrowding, are very effective, and Corfield himself gives an instance in which Buchanan thought overcrowding had had a good deal to do with the spread of the fever. In the American camps also it was considered to have been a potent factor. The effects of overcrowding and fatigue are also noticed by Munson. A great deal has appeared in the medical papers during the course of the South African war on the subject of enteric fever among troops on active service ; and a fresh discussion has lately taken place in the Medical Society of London, the outcome of which is that if the water-supply were in the first place protected and excreta disinfected, a great deal, but not all, would have been done to diminish the scourge.

Enteric fever—Prevention. Inoculation.—Corfield summarizes cases which have cast suspicion upon sewer air, and Munson states flatly that the disease may be transmitted by aërial infection from drains, water-closets, latrines, dust-heaps, &c. Corfield and also Schüder have pointed out generally and in detail the particular defects of insanitation which have been connected with actual outbreaks, and the general and some of the particular measures which should be taken to remedy them. Corfield quotes Buchanan as saying that it is the purification of the atmosphere from decomposing organic matters which has been most uniformly followed by a fall in the prevalence of enteric fever. The first thing, acccording to Schüder, is to protect the water, the second to destroy infection the moment it leaves the body of the sick, and the third to protect the attendants by inoculation. Reincke judiciously remarks that even when the water is infected every case does not arise from that ; but some from direct personal infection, some from secondary, tertiary, or more remote foci of infection developed in a latrine, on soiled linen, in a well, in a dairy, in a kitchen, in a gelatine pudding, &c. Agreeing with Duclaux, Schüder, and others, Firth and Horrocks insist that for a proper exercise of preventive measures attention must be concentrated on the dejecta the moment they leave the human body, because once the specific organisms become disseminated in nature, the task becomes stupendous on account of the number of the paths of infection. They point out the defects of the dry earth system in use in India, advocate the use of trough water latrines, and discourage the introduction of biological methods of sewage disposal. But the Government of India will not hurriedly give up the trenching system on account of evidence brought forward which probably only touches the results of bad trenching. Krieger, as has been mentioned, notes the opinion formed by Koch's German commission as to the necessity for greater attention to diagnosis, isolation and disinfection ; and Munson gives the practical rule that convalescent patients should not be permitted to return to duty or quarters till the bacillus has been absent from the urine for a week. The whole matter sums itself up as an effort to secure cleanliness in air, soil, and water. Inoculation has been treated of by Crombie and by Wright from a statistical point of view, while Besredka has suggested a new method of preparing vaccines.

Enteric fever—Opinions of medical officers.—The Medical Transactions of 1901 are even more barren than their predecessors of wholehearted or plausible attempts to explain the origin of outbreaks of enteric fever. Recognizing more than ever how little is really known of the natural history of the enteric bacillus, medical officers seem to have come to the conclusion that the less they say, the less they are likely to be wrong. Nearly forty of them state that they could find no cause for the cases which occurred. Of course, as usual, and especially in connexion with the movement of troops, many cases originated elsewhere than in the stations in which they were treated. About eight of the men attacked had very recently landed from England, and two cases occurred, at Colaba and Deolali, in men just off the ship, the disease appearing to have been contracted before arrival in India. Of Agra it is stated that recent arrivals in the station were more liable than residents, irrespective of their length of Indian service. At Quetta two-thirds of the cases occurred in the Cheshire Regiment, which arrived in that station during the year, and no particular barrack-room was affected. At Mhow the preponderance of cases was in the 20th Hussars, and the medical officer considered that the hygienic arrangements of the regiment must have been seriously at fault, nearness to the bazaar being perhaps a factor. The men of the Dorset Regiment at Ferozepore were supposed to have owed their particular liability to their weakly condition from the effects of malaria. Out of 21 cases at Meerut, 13 occurred in the 15th Hussars, but no cause was discovered for the greater incidence in that regiment. Several medical officers mention that the cases occurred in a scattered manner in various corps and barracks. No. 4 British cavalry barrack at Lucknow had a disproportionate number of cases ; but no sanitary defect could be found

in it, and the medical officer suggests that the men may have together frequented some place outside barracks, and got the infection there. At Ferozepore the bazaar was considered to be indicated as the source, because, while the rank and file were attacked, the staff remained free. As usual, in many cases the probable source was suspected to be in impure food or drink partaken of in bazaars and villages, when out walking, when out shooting, when travelling by train, when on the march, when attending camps of exercise and manœuvres ; and one medical officer states that even when bazaars are out of bounds, men try to get articles from them secretly. Heat and exertion were also mentioned as contributories. The filth pits were suspected at Ahmednagar, and filth-laden duststorms at Aden and Rawalpindi ; while at Bareilly the dhobi ghats were found to be too near the trenches, and had to be moved. Rawalpindi is considered by the medical officer not to be suitable for the Allahabad system of conservancy. The disease is stated to have been more prevalent than usual among the civil population of Agra ; and at Kirkee the occurrence of seven cases among the native followers was held to have proved that the surrounding population is a danger to the troops ; while suspicious cases were also observed among natives at Quetta and Peshawar. At Allahabad flies were said to be very numerous owing to the operations of the grass farm. Some of the patients attributed their illness to bad smells in the workplace or in the bazaar, to fatigue, exposure to the sun, getting wet. The increase at Jubbulpore was attributed to the arrival of some drafts from England, and at Ranikhet seven out of the 19 men attacked had been not more than nine months in India. At Dagshai the men were suspected of drinking water brought for ablution purposes ; at Lucknow of drinking direct from the taps, instead of using the pinked water. The hospital water at Khandalla was impure, owing to a leaky joint near the kitchen cesspit. The filtering arrangements being on too small a scale, filtered water is supplied to Colaba mixed with unfiltered. The result is that the water is sometimes discoloured and contains an excess of, non-pathogenic, bacteria. At Dinapore the well that has the Pasteur filter installation is said to be secure by its situation, and always to give a good analysis before filtration. The Fatehgarh water contains an excess of chlorides ; and the well in the sapper lines at Roorkee has a large excess of chlorides and hardness, supposed to be due to contamination of the subsoil water in its passage through the polluted soil of the lines and bazaar of the Bengal Sappers and Miners. Some stations are still evilly distinguished by the possession of that dangerous arrangement, a double water-supply. The water-supplies of Madras, Wellington, Rangoon, Mandalay, Schwebo, Meiktila, Poona, Ahmednagar, Mhow, Hyderabad, and Umballa are specially mentioned as being liable to contamination. But at Umballa, Subathu, Dum-Dum, and Barrackpore the water was not considered to have been concerned in the causation of enteric fever. Ten stations report the results of bacteriological examination, which were mostly negative as regards the presence of the enteric bacillus. A microbe having its cultural and tinctorial characters was found in the water bottle of a man who died of the disease at Poona. He was attacked shortly after returning to the cantonment from military training, and admitted having taken water from any source convenient while out in camp. Only in one sample, from No. 3 barrack, was an enteric-like bacillus found at Agra, but it did not react to the serum test. The Chakrata water did not contain any enteric microbes, but the colon bacillus was found in three samples. It has still proved impossible to obtain the respective average annual strengths of abstainers and non-abstainers, so that a legitimate comparison of the incidence of enteric fever on these two classes cannot be made. The nine medical officers who mention the point return 35 abstainers in 162 men attacked, or about 22 per cent. From a few stations it is reported that no system of purification of the water was used or needed. In most stations boiling and the use of potassium permanganate, and sometimes of alum, were continued. From remarks made here and there it appears to be doubtful whether the water always is really boiled ; whether the handling and exposure in the processes of "boiling" and cooling do not in themselves constitute a real danger ; whether the water when ready for drinking is always sufficiently protected ; and how far it is actually used by the men. In the hot weather of the plains, imperfectly cooled water flavoured with permanganate of potassium cannot be a very attractive drink. Considerable efforts seem to be made, in a number of stations at least, to secure the purity of the aërated waters. Most, if not all, soldiers use butter ; but a considerable number use no milk, not even in their tea, and a large number use it only in tea. The subject of dairy management is attracting increased attention, especially with regard to general and detailed cleanliness. Among the most frequently mentioned causes of diminution of enteric fever or immunity from it were the rarity of drafts from England

and the greater age and acclimatization of the men. Additional reasons reported from Bangalore were good water, sanitary improvements, and early diagnosis ; at Rawalpindi inoculation ; at Barrackpore the scrutiny of cases afforded by the use of Widal's test ; at Lucknow the establishment of a government dairy farm in the end of 1899, and a less crowded state of the Barracks ; at Rangoon protection of the wells ; at Jullundur the absence of the young soldiers in the hills ; at Calcutta pure water and great attention to sanitation ; at Nowgong sanitary improvements. Sialkot and Sitapur were immune for the second year in succession. At Rangoon the wells were protected by a concrete barrier all round to a depth of 20 feet ; at Neemuch the chatties were furnished with lids, and long-handled spoons were provided for taking out the water ; at Quetta the eating houses were placed out of bounds, and the troops went into summer camp ; at Agra the latrines of the British infantry lines were treated once a week with corrosive sublimate solution, and those of the Royal Field Artillery with carbolic acid ; at Nowgong the company officers took great interest in the sanitation of the cookhouses and the proper carrying out of the conservancy, and the stools and urine of every patient with diarrhœa and a temperature above normal were disinfected ; at Cherat, Chakrata, and Landour the use of metal vessels for the conveyance of water was introduced ; at Bangalore the stools of even suspicious cases were incinerated. Cooking by European soldier cooks has been started in a good many stations ; but there are certain difficulties connected with the hot weather, and the men themselves do not seem universally pleased with the result. Considerable, and in some cases systematic, use seems to have been made of Widal's test in the diagnosis of cases. As usual, a few anomalous results were recorded ; but, on the other hand, some obscure cases were securely identified as enteric fever. At Rawalpindi and Murree pure cultivations of the bacillus were made from the spleens of patients who had died of the disease. Two cases in hill stations were complicated with diphtheria. In one case at Quetta dysentery supervened after the enteric fever. In a fatal case at Saugor there were two minute abscesses of the liver, and at Jubbulpore a single abscess. Also, in one of the fatal cases returned under abscess of the liver, the hepatic affection was considered to have been possibly due to antecedent enteric fever. Out of the 776 cases of enteric fever which occurred throughout the army of India in 1901, 11 are noticed as having declared themselves among patients in hospital or among attendants. Out of these, 2 were in hospital for early venereal disease, 1 for warts of the penis and tubercle of the lungs, and 6 for other diseases ; and 2 were attendants on enteric fever cases (excluding one man who for more than three weeks before he was attacked had not been in attendance). At Kirkee a man was attacked who had previously suffered from the disease, in 1897 ; and at Quetta one was reinfected while attending hospital after a recent previous attack.

Enteric fever in 1901.—Notwithstanding the resumption of reliefs, there was again a decrease of both morbidity and mortality from enteric fever. Whether the improvement will be maintained after the ordinary system of reliefs has been somewhat longer re-established remains to be seen ; but, so far, the forebodings of last report have not been fulfilled. The number of admissions has steadily declined during the last three years, and it is, of course, possible that a certain amount of the credit may be due to inoculation, as well as to the scarcity of drafts ; but the idea most full of hope is that the reduction may be at least partly due to the work of the special sanitary officers, who, from 1898 onwards, have been engaged in finding out the sanitary defects of stations, especially of stations distinguished by outbreaks or endemic prevalence of enteric fever, and in guiding the authorities to the application of the proper remedies.

The admission rate is the lowest recorded since 1887. There were 776 admissions and 202 deaths, against 970 and 289 in 1900. The average duration of a case was over 55 days, and the average number constantly sick 117·07, which, being multiplied by 365, gives 42,730·55, the total annual loss of service due to sickness only from enteric fever

Enteric fever in the geographical groups.—Groups XIIa, VIII, V, and VI, had, as usual, high decennial ratios of admission ; and Groups II and X, and, to a less extent, I and IV, low ratios. In 1901, though four groups, including VIII and VI, which had the highest admission ratios of the year, showed higher ratios than in 1900, the admission ratios of all groups were below their decennial means. No less than four stations in Group VIII recorded admission ratios over 20 per 1000.

Enteric fever in stations.—Among the stations with strengths over 100 the highest admission ratios of 1901 were those of Nasirabad, Ahmednagar, Bareilly, and Mhow ;

and the highest death-rates those of Murree, Ferozepore, Kasauli, Cherat, and Nasirabad. Fifteen stations registered admission ratios over 20 per 1,000, and of these Neemuch, Nasirabad, Agra, and Mhow were in Group VIII. Five of the eight cases at Neemuch are said to have been contracted elsewhere, and no cause was discovered for the other three. The high rates at Kasauli are not explained. The highest decennial ratios were those of Subathu, Cherat, Taragarh, Dagshai, Benares, Agra, and Lucknow; while low ratios were most common in Burma stations and stations near the sea.

Relation of enteric fever to age and length of residence in India.—In 1901 the greatest liability to suffer and die from enteric fever was between the ages of 20 and 25 and in the first year of Indian service. In 1900 the incidence of the disease had been greater than in 1899 at all age periods except the second, and in all service periods except the first two; but in 1901 it was less than in 1900 in all age periods except the last, and in all service periods except the first. This last fact is probably connected with the arrival in India of about 8,700 men from home during the course of the year, though their arrival fortunately did not prevent the annual ratios of the whole army from falling. In 1901 under one year's service the liability to fall sick of enteric fever was at least twice as great as in any other period of service, and oftener three times or more.

Enteric fever and season.—In the lustrum 1896–1900, so far as can be gathered from the non-calendar returns of the army, the maximum months for India as a whole were April–May and August-September, especially the first month of each of these couples. In the same quinquennium Group XIIa had maxima in April–May and in July-September; Group VIII in April–May and in August–September; Group V in January, March–May, and November–December; Group VI in January, April–June, and November–December. Again, in the same five-year period 10 out of 14 stations had a spring maximum in April–May, and 9 an autumn maximum in July–September; that is, most of them had two maxima; but Dagshai had one long maximum, April-October, and Lucknow three, January, March–April, and November-December. The cold weather maximum appears to be most marked in Northern India, especially in Groups V, VI, VII, and VIII; and may possibly be connected with the more marked changes of season in those regions. A certain influence on the apparent climatic incidence of the disease must be exercised by the usual yearly arrival in October–March of unseasoned men; and it may be noted that in 1900, when there were no arrivals, the curves up to the maxima were not so steep as in the preceding and following years, and the maxima themselves were postponed. Various attempts have been made in this report and elsewhere to explain the regional and seasonal distribution of enteric fever in India, the latest, perhaps, being that of Aldridge; but it must be recognised that, though glimpses of the truth may have been thus attained, a complete explanation is yet to seek. The best authorities are still in doubt as to the relation of enteric fever to season; and Abbott has some justification for saying that the common assumption that enteric fever is mostly an autumnal disease is only correct for sporadic cases in places which do not offer a suitable medium for the development of the enteric bacillus, and that where the conditions are favourable to the bacillus, outbreaks are due entirely to the less or greater pollution of the channels through which the germs can be diffused. Grünbaum has begun investigations as to whether there is any seasonal variation in the bactericidal power of the blood as a possible factor in epidemiology.

Plague and some other general diseases.—In the men of the European army of India there occurred only three cases of plague (two admissions) with one death; one admission at Belgaum and one "on the march," and one death at Ahmedabad. This comparative immunity is no doubt due in part to the great care taken to prevent men coming in contact with the disease, by putting infected areas out of bounds, &c. No officers or children were attacked, and the two women who were admitted, one at Bangalore and one at Bellary (infected at Bangalore), both recovered. It is mentioned that some plague occurred in the native followers of the Royal Field Artillery at Kirkee.

A single case of cerebro-spinal fever, a fatal one, occurred at Mhow. The wide-spread incidence of this disease among natives is mentioned in subsequent sections of the present report. Measles was sometimes contracted from the Boer prisoners. Out of

the 28 cases of beri-beri, 25, with all the three deaths, were returned from Burma, Shwebo and Mandalay having 20 cases between them. The medical officer at Rangoon does not understand how Europeans get the disease, if it is conveyed in rice; but he does not mention whether the soldiers ever drink the native rice liquor. No arsenic was found in the beer supplied to the troops at Mandalay and Meiktila. No cases of dengue were returned.

Tubercle of the lungs.—There was no change in the morbidity, but a fall in the mortality from tubercle of the lungs. For the quinquennium the pulmonary tubercle mortality of the European troops, as well as of the native, was highest in the Bengal Command, that of Bengal being highest for native troops, and that of the Punjab for European in 1901. The mortalities of European troops, of native troops, and of prisoners for the year were as 9, 16, and 75.

Pneumonia and other respiratory diseases.—The admission and the death-rate from pneumonia rose, the former being also higher than the decennial ratio. Burma Inland and the Hills groups had the highest admission ratios, a relation which is not usual, and does not appear to be connected with the distribution of influenza. December was the maximum month, and August the minimum. Khanspur in the Murree hills had the highest admission and death-rates.

With the exception of the Convalescent Depôts, Burma Coast had, as usual, the highest admission ratio for other respiratory diseases. Chaubattia and Campbellpur had the highest hills and plains ratios, respectively; and four other hill stations or depôts and five other plains stations or depôts had admission ratios over 50 per 1000. The high ratio at Umballa was due to the Essex Regiment, which had arrived from Burma, and was under canvas at the beginning of the cold weather.

Dysentery and diarrhœa.—The admission rate from dysentery fell, but the death-rate rose somewhat. Dysentery was, as usual, most prevalent in the Bengal-Orissa group; but it was nevertheless more prevalent, though not so fatal, in the Madras than in the Bengal Command. The maximum period was August-October, and the maximum month September. By far the highest admission and death ratios were those of Barrackpore (304·5 and 28·85); while Dum-Dum had the next highest admission rate (98·8) and Meean Meer the next highest death-rate (11·14). With reference to his former idea that the prevalence of the disease was due to the dampness of the subsoil, the medical officer notes that 1901 was drier than usual. He thinks that the poison is in the barracks or their vicinity, very likely in the latrines and urinals; and that the most important predisposing cause is chill. The men in barracks suffered out of proportion to the married families and staff and departments, and the medical officer asserts that not a single case occurred among the large civil population. One medical officer attending on the cases contracted the disease.

From the conflict of opinion there seems to be emerging the conclusion that in India, as elsewhere, there are two main forms of dysentery; the bacillary, and the amoebic, of which the latter only is apt to be followed by abscess of the liver. Miss Sheldon Amos, however, as the result of a critical review of the literature feels herself forced to the conclusion that no organism has been finally shown to cause any one form of dysentery. The amoebic form as it occurs in Calcutta has been carefully described by L. Rogers. For the benefit of the inexperienced observer it should, however, be noted that recently Shiga, in criticizing the published results of Jaeger, who had reported the existence of amoebic dysentery in East Prussia, calls attention to the fact that the *Amoeba dysenteriae* is not the *Amoeba coli*, and that the finding of the latter in any case proves nothing. The *Amoeba dysenteriae* is from three to five times larger than the *Amoeba coli*, and the boundary between its endoplasm and its ectoplasm is much sharper; its movements and changes of form are much more lively; and it occurs in far greater numbers in the stool. From their great proneness to suppuration of the liver, it would appear that in India Europeans are more liable to amoebic dysentery than natives are; but reason of this, if it is a fact, is not known. E. Pfuhl found the bacillus to remain alive in damp garden earth 101 days; in loose dry sand 12 days; on linen 17 days; in water in the ice-box 9 days, and in water at room temperature 5 days; in Seltzerwater 23 days; in milk 8 to 27 days; in butter 9 days; in Gervais cheese 9 days. Krieger notes that Koch's enteric fever commission are of opinion that the same measures are required against dysentery as against enteric fever.

The admission and death-rates from diarrhœa fell, especially the latter. The admission rates of groups varied between 23·2 in Central India, and 1·0 in Burma Coast. The highest station ratios were at Landour, Meean Meer, and Barrackpore. There was no cholera at any of these stations.

The prevalence of disorders of the digestive system at Umballa was ascribed to drinking on the receipt of bounty money.

Hepatic abscess.—Both the admission and the death-rates from abscess of the liver fell, the former very slightly. The Bengal Command and the Bengal-Orissa group had the highest ratios of admission and mortality. There were 5 deaths at Barrackpore ; and the highest admission and death ratios were those of the same station. Of the 11 cases at Barrackpore, 9 were associated with or sequent on dysentery. In one case each at Neemuch and Kurrachee abscesses of the liver were associated with typhlitis.

As due to abscess of the liver were returned 83 deaths, but to these may be added 18 returned under other heads (dysentery, enteric fever, &c.) in which examination of the body after death showed the presence of abscess of the liver. In these 101 the post-mortem record is complete only for 56, of which 33 were associated with ulceration, and 23 not associated. Three were noted as being associated with dysentery, but without ulceration ; and three as being associated with ulceration, but without dysentery.

Excluding 83 cases in which post-mortem examination was omitted or was incomplete, the total number of fatal cases of which abscess of the liver was found in the 6-year period 1896–1901 was 509. In 271, or 53 per cent., there was found ulceration of the intestine, and in 238, or 47 per cent., no ulceration ; in 171, or 34 per cent., there was a single abscess, and in 338, or 66 per cent., there were more than one.

Among the 271 associated with ulceration, there was a single abscess in 73, or 27 per cent., while there were multiple abscesses in 198, or 73 per cent. On the other hand, when the suppurative hepatitis was unassociated with ulceration there were 98 cases, or 41 per cent., in which the abscess was single, and 140, or 59 per cent., in which the abscesses were multiple.

Again, out of the total of 171 single abscesses, 73, or 43 per cent., were associated with ulceration, and 98, or 57 per cent., not so associated. In contrast to this, among the 338 cases of multiple abscesses, 198, or 59 per cent., were associated, 140, or 41 per cent., unassociated, with intestinal ulceration.

From his experience in Calcutta, L. Rogers finds that the form of bowel disease associated with the large tropical abscess of the liver is amoebic dysentery, though severe sloughing forms of catarrhal dysentery may be associated with small multiple pyaemic abscesses ; that the amoeba is constantly found in an active condition in the wall of tropical abscess of the liver, although frequently absent from the pus in its cavity ; that other organisms are absent from the pus when the abscess is first opened ; and that dysentery or dysenteric lesions are present in at least 90 per cent. of the cases. On the other hand, Manson is somewhat sceptical with regard to both amoebic dysentery and amoebic abscess. Miss Sheldon Amos, in the critical review quoted in last paragraph, does not consider the causative relation of the amoeba to liver abscess as by any means settled.

Venereal diseases.—The admission rate from venereal disease for India was 276·0, against 298·1 in the previous year, and 313·4 in 1899. In other words, in 1901 for every 1,000 men there were about 22 fewer admissions to hospital for venereal disease than in 1900. From the reports of medical officers it appears that some of the principal causes of decrease were believed to be—the greater age and experience of the men, which made them more cautious and more ready to listen to advice ; the working of the cantonment general hospitals ; the interest taken in the matter by regimental and other authorities ; the comparative absence of famine-stricken women ; the more prolonged treatment of constitutional disease ; various measures taken to protect the men ; the out-patient system. Lectures and warnings were frequently addressed to the men by medical officers, chaplains, and regimental officers ; measures were taken to prevent the women being in evidence or soliciting the men ; dangerous places were placed out of bounds ; concerts and other evening amusements were provided.

Alcoholism.—There were 11 deaths from alcoholism, giving a ratio of 0·18, both figures being above those of the two years preceding. The yearly average number of deaths in the decennium 1891–1900 was 7 ; so that the figures of 1901 were considerably above the average. In some cases the receipt of bounty money led to drinking.

Heatstroke.—The heatstroke death-rate for India fell, the decrease being chiefly in Madras, and to a less extent in Bengal. Campbellpur, Delhi, Nowgong, and Deesa had the highest admission ratios, and Meerut and Campbellpur the highest numbers; Deesa and Benares the highest death-rates, and Aden the greatest number of deaths.

Invaliding.—In the whole army of India 2,393 men were invalided, or 39·33 per 1,000 of strength, against 2,026 and 33·46 in the preceding year, the increase being greatly due to the larger number of men invalided for malarial fevers and for debility, and being shared in by all the commands except Madras. The proportion of invalids to strength was lowest in Bengal, and highest, as usual, in Madras. The increase was greatest in the Punjab and Bombay; and in these two commands Ferozepore and Kurrachee, probably on account of the malarial outbreak described in the report for 1900, had most invaliding from ague, Meean Meer and Kirkee from debility. The percentage of men who were invalided while under 25 years of age to the whole number invalided was 42, against 52 in 1900, and of those under 30 years of age 88 per cent., against 90. Of the total number of men invalided, 14 per cent. (against 33) were of less than two years' service, and 60 per cent. (against 72) were of less than 5 years' service. The fall in these percentages in 1900 and again in 1901 is due to the comparative absence of drafts, the army standing fast for most of the time and increasing its age and length of Indian service.

Officers.—The chief causes of admission among officers were ague and simple continued fever; and, while the admission rates from tubercle of the lungs, hepatic abscess, influenza, venereal disease, and simple continued fever rose, those from cholera, small-pox, enteric fever, malarial fevers, and dysentery fell. The chief cause of death was enteric fever, and the ratio was higher than in the previous year. Malarial fevers and abscess of of the liver had also increased ratios. The admissions from influenza, fevers, except ague, diarrhœa, and hepatitic affections were higher than among the men; as were also the death-rates from fevers, circulatory diseases, and hepatic abscess. One officer suffered from a second attack of enteric fever, twenty years after the first. Two officers who suffered from enteric fever at Poona, came from the same bungalow; they had been out shooting and had drunk any water they could get. There was nothing insanitary about the bungalow, but they did not know where their milk came from, or whether it was boiled. The officers' kitchen was found to be insanitary. One officer at Roorkee had been reckless about water and native sweets. At Ahmednagar the disease was thought to have been probably contracted at the mess, as the cook and the mess waiter had both been admitted to hospital for the same disease. One officer at Murree contracted the fever through milk from an insanitary dairy which infected other people in the station.

Women.—The health of the women was decidedly better than in 1900. The chief causes of admission were debility, ague, and the diseases peculiar to women. All the diseases tabulated had lower admission ratios, except influenza, pneumonia, and other respiratory diseases. Debility caused about 39 per cent. of the total admissions, and ague about 17 per cent. The chief cause of death among women was enteric fever, which caused nearly 26 per cent. of the total deaths. Most of the diseases tabulated showed greatly reduced death-rates, but mortality was increased from hepatic abscess, pneumonia, tubercle of the lungs, ague, and enteric fever. As to the causation of the enteric fever, no special remarks are made in the reports.

Children.—There was a great improvement in the health of the children. The chief causes of admission were ague and respiratory diseases. All the diseases tabulated gave diminished admission rates, except whooping cough, cholera, small-pox, enteric fever, and influenza. Ague caused over 23 per cent. of the total sickness, and respiratory diseases nearly 14 per cent. The chief causes of death were diarrhœa and convulsions. Among the causes of death tabulated, only convulsions, cholera, small-pox, and dysentery showed increased mortality. Diarrhœa caused nearly 23 per cent. of the total deaths, and convulsions over 14 per cent. Half the total number of cases of measles occurred at Quetta and Bangalore. Quetta had also the highest number from chicken-pox. In four out of the six cases (five admissions) of tubercle, the intestine, peritonæum, or lymphatic glands were affected; and a fifth was returned as general tuberculosis. The four children who died from tubercle were from two to six years of age. Nothing is said as to the causation of the enteric fever cases.

The liability to death was greatest under six months, the height of the percentage being, as usual, to a considerable degree due to cases of immaturity at birth.

Native Troops.

The health of the native troops was, on the whole, better than in the preceding year, the improvement being in the death-rate. For the population generally the year was one of recovery after famine and epidemic disease.

Year.	Average strength *	Ratio per 1,000 of Strength.							
		Admissions into hospital.	Constantly sick.	Deaths from					Mortality, including absent deaths.
				Cholera.	Remittent Fever.	Pneumonia.	Dysentery.	All causes.	
1896–1900 ...	127,223	781	30	1·03	1·14	3·36	·51	11·81	15·69
1900	123,463	785	30	3·16	1·34	3·32	·63	14·04	18·57
1901	122,800	829	30	0·15	0·12	2·72	·38	10·68	13·89
1891–1900 ...	127,666	852	32	1·11	1·25	3·24	·59	12·22	16·62

* The quinquennial and decennial ratios are, *of course*, worked on the total strength of the lustrum and decade respectively.

The chief cause of admission was ague, and then, with a long interval, came dysentery, venereal disease, and non-pneumonic respiratory disease. Though there were raised admission ratios from influenza, malarial fevers, and respiratory diseases other than pneumonia, there were lessened ratios from cholera, small-pox, enteric fever, bowel complaints, and venereal disease. Ague caused 43 per cent. of the total admissions. The chief causes of death were pneumonia and remittent fever. Among the diseases which caused increased mortality were ague and tubercle of the lungs ; but mortality from cholera, diarrhœa, dysentery, and debility was reduced. Pneumonia caused over 25 per cent. of the total deaths, and intermittent and remittent fevers nearly 21 per cent. The total number invalided for discharge was 1,566 and the chief causes of invaliding were debility, ague, rheumatism, and venereal disease.

The China Expeditionary Force and the China Garrison enjoyed good health, but that of the Ogaden Punitive Force and of the still smaller Ad Dariga Field Force was not so good.

If the following table be compared with that on page 46, it will be seen that the native soldier suffered less from enteric fever, simple continued fever, diarrhœa, hepatitic affections, and venereal diseases ; and more from each of the other causes of admission given than his European comrade. He also suffered more from scurvy. These relations are usual, except with regard to tubercle.

Ratios of Commands.

—	Ratio per 1,000 of the Average Strength.					
	Bengal Command.	Punjab Command.	Madras Command.	Bombay Command.	Hyderabad Contingent.	Army of India.*
I.—Average Annual Strength	26,200	46,050	18,622	22,428	5,826	122,806
II.—Constantly-Sick-rate of the Year... ...	27·4	30·5	28·4	35·0	20·6	30·3
III.—Admission-rate of the Year :						
Influenza	7·5	14·7	·2	3·2	11·7	9·7
Cholera	·9	·1	·4	—	—	·3
Small-pox	·3	·4	·7	·6	—	·4
Enteric fever	·4	·3	—	·1	—	·2
Intermittent fever	261·8	424·9	262·2	431·6	237·4	358·4
Remittent fever	9·7	21·7	6·3	14·6	5·7	14·3

* Excluding troops in China and in British East Africa, and including troops in Extra India not in the India Command.

Ratios of Commands—continued.

—	Ratio per 1,000 of the Average Strength.					
	Bengal Command.	Punjab Command.	Madras Command.	Bombay Command.	Hyderabad Contingent.	Army of India.*
III.—Admission-rate of the Year—*continued:*						
Simple continued fever	2·5	3·1	14·1	4·5	·5	4·9
Tubercle of the lungs	5 8	5·3	1·7	3·5	1·0	4·2
Pneumonia	9·2	17·4	5·0	15·3	5·0	12·7
Other respiratory diseases	20·0	46·2	22·6	31·7	14·1	32·6
Dysentery	31·0	54·2	27·1	40·8	21·1	43·2
Diarrhœa	5·8	11·6	2·9	13·3	2·7	8·9
Hepatic abscess	·2	—	·1	·1	—	·1
„ congestion and inflammation ...	·9	·5	1·5	2·1	·3	1·0
Scurvy	1·9	3·1	·2	8·2	1·7	3·2
Venereal diseases	30·2	20·6	46·8	53·5	37·8	34·3
All Causes	666·8	944·1	698·6	933·3	543·4	828·8
IV.—Death-rate of the Year:						
Cholera	·46	·07	·21	—	—	·15
Small-pox	—	·02	·11	·04	—	·03
Enteric fever	·15	·22	—	·04	—	·12
Intermittent fever	1·18	·63	·81	1·52	·34	·98
Remittent fever	·80	1·72	·86	1·38	·51	1·25
Simple continued fever	—	·02	·05	·09	—	·03
Circulatory diseases	·23	·11	·32	·13	·17	·20
Tubercle of the lungs	1·11	1·06	·48	·71	—	·84
Pneumonia	1·30	3·87	·81	4·01	1·03	2·72
Other respiratory diseases	·31	·63	·16	·45	·51	·48
Dysentery	·31	·17	38	·80	·51	·38
Diarrhœa	—	·11	·05	·22	—	·09
Hepatic abscess	·08	·02	·05	·13	—	·06
Anæmia and debility	·08	·09	·05	·31	·17	·14
All Causes	8·44	12·03	8·80	12·93	4·81	10·68

* Excluding troops in China and in British East Africa, and including troops in Extra India not in the Indian Command.

Commands.—Of the commands, Bombay was the most unhealthy, but it was healthier than in 1900. It had the highest mortalities from ague, remittent fever, pneumonia, dysentery, diarrhœa, hepatic abscess, and debility. The highest mortality from cholera and tubercle of the lungs was in Bengal; the highest from enteric fever (on account of the number of Gurkhas) and from non-pneumonic respiratory diseases, and the second highest from pneumonia, in the Punjab; and the highest from small-pox in Madras.

Geographical groups.—The most unhealthy group for the decennium was Assam; but for 1901, the Hills. Burma Coast had the highest admission rate from dysentery and hepatitis, the second highest from venereal disease, and the lowest from ague, non-pneumonic respiratory diseases, and diarrhœa; Burma Inland the highest from ague, simple continued fever, respiratory diseases other than pneumonia, and the lowest from tubercle of the lungs; Assam the highest from enteric fever and abscess of the liver, the lowest from venereal disease, and no pneumonia; Bengal-Orissa the highest from scurvy; Gangetic Plain the highest from cholera and tubercle of the lungs; Deccan the lowest

from dysentery; Western Coast the highest from diarrhœa and venereal disease; Southern India the highest from small-pox and the lowest from remittent fever; the Hills the highest from influenza, remittent fever, and pneumonia, and the second highest from tubercle of the lungs, non-pneumonic respiratory diseases, and scurvy. Scurvy was also high in Indus Valley, and pneumonia in Upper Sub-Himalaya. For the decennium too the highest influenza and remittent fever ratios were in the Hills, the highest enteric fever ratio in Assam, the highest ague ratio in Burma Inland, and the lowest remittent fever ratio in Southern India.

Ratios of Geographical Groups.

—	Ratio per 1,000 of the Average Strength.												
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	
	Burma Coast and Bay Islands.	Burma Inland.	Assam.	Bengal and Orissa.	Gangetic Plain and Chutia Nagpur.	Upper Sub-Himalaya.	North-Western Frontier, Indus Valley, and North-Western Rajputana.	South-Eastern Rajputana, Central India, and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	Army of India.*†
I—Average Annual Strength	1,452	4,084	1,472	2,287	5,564	15,263	16,051	10,994	14,468	2,021	6,436	20,936	122,806
II.—Constantly-sick-rate of the Year.	25·5	34·8	46·4	42·1	25·8	24·6	31·9	36·5	26·4	32·9	31·6	34·6	30·3
III.—Admission-rate of the Year:													
Influenza	2·1	—	·7	—	11·9	1·5	1·7	8·1	4·7	—	·2	15·0	9·7
Cholera	—	—	—	·9	2·9	·3	·1	—	—	—	1·1	·1	·3
Small-pox	—	—	—	·9	·5	·3	·9	·4	·3	·5	1·7	·4	·4
Enteric fever	—	—	4·8	—	·4	·3	·1	—	·1	—	—	·4	·2
Intermittent fever	97·1	714·0	578·1	411·0	191·2	243·1	430·6	520·8	224·1	281·5	180·4	391·3	358·4
Remittent fever	9·0	6·6	13·6	24·0	5·0	12·8	16·9	13·2	6·7	20·3	3·7	33·1	14·3
Simple continued fever ..	2·1	32·1	—	—	·2	·3	1·0	10·7	6·8	10·9	3·7	1·4	4·9
Tubercle of the lungs ..	2·8	1·0	3·4	2·2	8·4	5·6	4·8	4·1	1·7	1·5	3·0	7·4	4·2
Pneumonia	1·4	2·0	3·4	4·4	8·6	18·0	14·6	15·3	6·4	12·4	8·9	18·6	12·7
Other respiratory diseases	10·3	48·5	24·5	30·6	26·2	28·7	39·9	23·6	19·3	24·7	16·2	42·8	32·6
Dysentery	63·4	34·8	46·2	41·1	42·2	31·4	55·7	26·2	18·5	52·9	24·9	48·9	43·2
Diarrhœa	·7	5·1	19·0	9·6	5·6	4·3	12·1	9·8	2·9	23·3	3·4	10·7	8·9
Hepatic abscess	—	·2	·7	·4	·2	·1	—	—	·2	—	—	—	·1
„ congestion and inflammation.	2·8	·7	1·4	1·3	·9	·2	·4	2·5	·9	2·0	1·9	1·1	1·0
Scurvy	—	·2	·7	7·9	1·1	2·2	4·6	2·9	1·9	2·5	·3	6·5	3·2
Venereal diseases	68·9	27·4	17·0	31·9	22·1	24·3	18·8	59·9	58·4	69·3	47·7	33·5	34·3
All Causes ..	544·8	1,213·5	1,081·5	851·8	624·7	656·9	956·9	1,023·8	602·4	842·2	655·1	945·1	828·8
IV.—Death-rate of the Year:													
Cholera	—	—	—	·87	1·80	·13	·06	—	—	—	·62	—	·15
Small-pox	—	—	—	—	—	—	·06	—	—	—	·31	·05	·03
Enteric fever	—	—	1·36	—	·36	·20	·12	—	—	—	—	·29	·12
Intermittent fever	·69	1·96	2·04	1·75	1·98	·72	·94	1·91	·28	1·48	·47	·67	·98
Remittent fever	1·38	1·47	—	1·75	·90	1·24	1·30	1·46	·48	·49	·62	2·91	1·25
Simple continued fever ..	—	—	—	—	—	—	·06	—	·07	—	·16	·05	·03
Circulatory diseases ..	—	·49	·68	—	·18	·13	·18	·09	·07	·48	·47	·24	·20
Tubercle of the lungs ..	·69	·24	·68	·44	·90	·92	·53	·82	·21	1·49	·47	2·20	·84
Pneumonia	·69	·24	—	1·31	1·98	2·56	3·13	3·73	·97	2·97	1·40	4·82	2·75
Other respiratory diseases	—	·24	—	·87	·36	·39	·71	·45	·21	·99	·31	·53	·43
Dysentery	·69	·73	—	2·19	·36	·20	·12	·36	·35	1·48	·47	·33	·38
Diarrhœa	—	·24	—	—	—	—	·18	·27	—	—	—	·14	·09
Hepatic abscess	—	—	·68	—	·18	—	—	—	·21	—	—	·10	·06
Anæmia and debility ..	—	—	—	—	—	·13	·06	·09	·14	·49	—	·33	·14
All Causes ..	13·09	9·06	5·43	11·81	12·58	9·37	10·09	11·46	6·22	14·84	10·25	15·19	10·68

* Including Group Extra India.
† Excluding troops in China and in British East Africa, and including troops in Extra India not in the Indian Command.

Stations, regiments.—The highest death-rates of the large stations throughout India with a strength of not less than 1,000 were those of Bombay, chiefly from pneumonia, plague, dysentery and ague; of Meean Meer, chiefly from pneumonia and remittent fever; of Dera Ismail Khan, chiefly from pneumonia and ague; of Edwardesabad (Bannu), chiefly from pneumonia and remittent fever; of Abbottabad, chiefly from tubercle of the lungs; and of Bakloh, chiefly from tubercle of the lungs and remittent fever. Among the regiments mentioned in the following paragraphs the most unhealthy were the 28th Punjab Infantry, the 21st Madras Pioneers, and the 17th Bengal Infantry on the frontier, the 13th Bombay Infantry at Deesa, the wing of the 12th Burma Infantry at Keng Tung, and the 28th Bombay Pioneers at Kirkee and on the frontier. The two Pioneer regiments were at work on the Khushalgarh-Kohat-Thal Railway. All these regiments suffered from ague, the Madras regiments from simple continued fever in addition, the 28th Bombay Infantry from diarrhœa, and the 28th Punjab Infantry from remittent fever and pneumonia.

Influenza.—The influenza admission ratio was more than ten times greater than in the previous year, though not so high as in 1899. February was the maximum month in 1901, but for the 12 years' period April, with the minimum in October. The highest numbers were at Malakand, Bakloh, Dharmsala, and Benares in India, and among the troops serving in Mauritius. All these outbreaks were compact. The native troops suffered slightly more than the European troops, but much less than the prisoners. The type of the disease appears to have been mild.

Cholera.—There were only 35 cases of cholera with 19 deaths, against 666 cases (641 admissions) with 390 deaths in the preceding year; and the admission and death-rates were, of course, much reduced, and also much below the decennial rates. Cholera reached its maximum in August, and occurred in eight months of the year. The most important outbreak was that of only 12 cases at Fyzabad, of which 11 occurred in the 6th Bengal Infantry and one in the 7th Bengal Lancers. The first man affected in the former had visited the city, where the disease was prevalent, but no exact connexion was discovered; and the man affected in the Lancers had, against orders, visited the infantry lines while the cholera cases were occurring. The three cases in the 1st Bengal Lancers occurred while cholera was prevalent in Lucknow, but no connexion was established between the civil and the military cases, and the possibility of the latter having been really due to ptomaine poisoning is mentioned. There was no cholera in Umballa when the three cases in the 40th Pathans were seen; and it is stated that they were caused by unsound fruit, and that as soon as fruit was forbidden no more cases occurred. But the usual precautions, such as permanganating the water-supply, &c., had been adopted. As to the other regiments affected, the only point mentioned, when anything is said at all, is the presence of the disease in the neigbourhood.

Small-pox.—There were 55 admissions (58 treated) from small-pox with four deaths against 78 (86 treated) with four deaths in the preceding year, and the admission ratio was below the decennial. The highest numbers were nine at Bangalore with two deaths, seven at Bannu without death, six at Quetta with one death, and five at Dera Ismail Khan with one death. The highest regimental number was five in the 4th Sikhs at Bannu. All had good marks of vaccination, and all recovered. The disease came from the bazaar. Two of the men infected in the 2nd Moplahs were pitted from a previous attack; while the third contracted the disease after he had joined the regiment, but before his vaccination had been carried out.

Ague, remittent fever, simple continued fever.—To ague was due over 43 per cent. of the sickness of the native army. Six of the geographical groups had lower ratios, and six higher; but the total increase was greater than the total decrease. The most malarious group was Burma Inland, and it was more malarious than in 1900; but the greatest increase of the ague admission ratio was in Assam. The most malarious month was October, and the least malarious February. The stations with strengths over 100 which had ague ratios higher than 1,000 per 1,000 were, in order, Keng Tung, Kajuri Kach, Deesa, Wana, Bhamo, Rajkot, and Saidgi. The highest admission numbers were recorded in the 21st Madras Pioneers and the 28th Bombay Pioneers, which were employed on railway excavation in malarious valleys on the north-west frontier. The disease in the latter seems to have been of more severe type than in the former. Anopheles mosquitoes were found in the tents, and their larvæ in the neighbouring swamps. The 17th Bengal Infantry was in camp most of the year, in great heat at Suliman Khel, and the men had

to make entrenched camps and build shelters for themselves. No explanation is given with regard to the 13th Bombay Infantry at Deesa. The 28th Punjab Infantry was at Wana, and the anopheles was present, though its breeding places were not discovered. In the report for the Wing of the 12th Burma Infantry at Keng Tung, it is noted that the situation is a lowlying rice-growing valley shut in on all sides by high jungle-covered mountains; that great meteorological variations take place; that the men are badly housed, strange to the place, not careful, and that some had already suffered from fever on the march to Keng Tung.

Remittent fever caused nearly 12 per cent. of the total deaths, and prevailed most in July and least in March, though there was no month that had fewer than 80 admissions. The maximum and minimum of the previous year had been in October and February. The death-rate was high but lowered, the admission rate low but raised. It was most prevalent in the Hills, Bengal-Orissa, and Western Coast. The greatest numbers of cases were at Kila Drosh and Kohat. The 28th Punjab Infantry at Wana and the 10th Madras Infantry at Maymyo had the highest numbers; but in the latter the number had subsided since it left Keng Tung. Next came regiments at Bombay, Almora, Dâtta Khel, and Alipore.

The prophylactic use of quinine does not yet seem to be sufficiently general, sufficiently systematic, early enough begun, or long enough continued.

The 21st Madras Pioneers on the frontier and the 33rd Madras Infantry at Thayetmo had the most cases of simple continued fever. In the report of the latter regiment it is stated that they must be attributed to heat, exposure to the sun, and change of season, and that during the prevalence of simple continued fever there was hardly any case of ague. In the 4th Rajputs at Agra 52 cases were attributed to heat and two to malaria, but the medical officer writing the report is of opinion that probably all were malarial.

Enteric fever, Malta fever.—The admission rate from enteric fever was only half as high as in the preceding year, and the death-rate was also diminished. The ratios for native troops and prisoners are very unlike those for European troops. The statistics do not yet reflect the opinion, so prominent of late, that enteric fever is quite common among natives; and so long as medical officers return few cases, the statistical tables cannot show many. As a matter of fact, in spite of the way in which the attention of medical officers has been called to the possibilities, the number of cases and the ratio were lower than in seven out of the ten years preceding, and below the averages. The years of most enteric fever were 1892, 1897, and 1900. As usual, the total fever mortality of native troops was considerably below that of European troops, as 30 : 49, which seems to indicate that native soldiers really succumb to enteric fever less than their European comrades.

To his 11 cases, mentioned in last report, Lamb has added 10 diagnosed by the serum test, all occurring in Poona in the space of nine months—eight Hindus (six Brahmans), one Parsee, and one native Christian. In Calcutta too, L. Rogers met with 13 cases, diagnosed by the same method, in five months; high class and low class, native Christians, Hindus, and Mussulmans; and one showed marked typical lesions on post mortem examination. A fourteenth case was subsequently tested with a positive result; and then occurred an outbreak of seven cases in a high class Hindu family, children from 5 to 18 years of age, and the blood of the youngest was sent for examination, and gave the reaction. Some regimental cases similarly tested are noticed below. The value of such observations depends, of course, on the trustworthiness of the serum reaction as a test, on the correctness of the technique adopted, and on the competency of those who employ it. The best testimony to the value of the reaction is perhaps the fact that those who use it most have most confidence in it. But it must be conceded that unexpected results are often obtained, some explicable, some not; and that both in Europe and in India experts make mistakes. At the recent meeting of the British Medical Association, Manson related an instance in which he submitted a case of doubtful fever to three experts; one affirmed that the blood gave the reaction of Malta fever, a second declared that it was from a person suffering from typhoid fever, and a third that it was neither of Malta fever nor of typhoid fever. Manson, therefore, asks investigators not to place too great reliance upon serum tests in cases of doubtful forms of illness. Köhler probably goes too far in denying the specific character of the reaction, but his criticisms are calculated to do good by preventing enthusiasts from going too fast. Other cases here and there have been reported among natives of India, not all tested by the serum reaction. The disease is said to be rare in the natives of Egypt and Algeria in the black and red

troops of the United States' army, and in the native and halfcaste soldiers of the French army; and from 40 testings of the blood of Arab children, of which only two were positive (5 per cent.), Brault concludes that no support is lent to the view that adult immunity depends upon a prevalence of the disease in childhood. But the difference of race makes it desirable to have similar observations made independently for India.

In the whole native army of India 26 admissions (27 treated) with 15 deaths were returned, as against 54 (55 treated) with 18 in 1900. Manipur, Abbottabad, and Ferozepore had the highest numbers of cases. To the total 16 regiments contributed, the maximum being six in the 3rd Bengal Infantry at Manipur. The medical officer states that in all the diagnosis was confirmed by the serum test, that the blood of three men who had been in hospital the previous year for "remittent fever" was also found to re-act with the enteric bacillus, and that he has no doubt that mild cases occurred without being detected. In no case was the origin of the disease traced, though in six, water or milk was suspected in a general way. The infection in two cases appeared to have been contracted in hospital, and in one on the march. One of the men affected was a lately joined recruit, and another had only a month's service. In only two of the fatal cases, at Abbottabad, was a postmortem examination obtained, but the result in both confirmed the diagnosis.

There were returned six cases of Malta fever, three from the 40th Pathans, one at Umballa and two at Jhansi, and one each in three other regiments. The medical officer of the 40th Pathans states that the three cases were all diagnostically confirmed at the Kasauli Pasteur Institute by the serum test; and that in addition three or four doubtful cases occurred. In former volumes instances have been cited of the diagnosis of Malta fever in natives of India, and recently that disease has been reported to occur in Assam.

Plague. Cerebrospinal fever.—In 1901 there were 70 cases (69 admissions) of plague with 41 deaths, against 56 with 29 in 1900, 76 with 45 in 1899, and 94 with 58 in 1898. The highest numbers for regiments were 12 in the 15th Madras Infantry at Belgaum and nine in the 1st Madras Lancers at Bellary. The other regiments affected were stationed at Bangalore, Poona, Bombay, Karachi, Ahmedabad, Benares, and in Mauritius, in all of which places the civil population was suffering. In the regiment at Belgaum only three of the cases occurred after the regiment had been reinoculated, some of the men for the third time; and in the regiment at Bellary no inoculated men were attacked. The origin of the two cases which occurred in the 19th Madras Infantry in Mauritius was not apparent, as places where plague prevailed were strictly out of bounds, and no dead rats were found. As the sepoys had been ordered to wear boots at all times, it was interesting to note, says the medical officer, that one of the men affected had the bubo axillary and the other cervical.

Cerebrospinal fever increased from three admissions with two deaths in 1900 to 28 admissions with 21 deaths in 1901. The highest numbers were six in the 8th Bombay Infantry at Delhi, five in the 47th Sikhs at Sialkot, four in the Chitral garrison, and three in the 32nd Pioneers at Jhelum. There were also two at Lucknow, two at Miranshah, and one each at Datta Khel, Jubbulpore, Kamptee, Bannu, Sialkot, and Peshawar. The medical officer of the 5th Madras Infantry at Jubbulpore notes the occurrence of the disease in the Central Prison at that station, and there was a suspicious case of meningitis in the jail at Delhi. In the report on the Chitral garrison the medical officer notes that the disease was epidemic in the lower part of the Chitral valley in the early part of the year, having apparently spread from Asmar, where a similar disease was prevalent, according to bazaar rumour; and that it was also epidemic to the west of Chitral, in Kafiristan, as he had seen some cases in the Utzen valley, and had been told that a large number of persons were dying of the same complaint in the interior. In the pus from the brain and cord of one of the Jhelum cases the Chemical Examiner found the diplococcus. In the 2nd Punjab Infantry overcrowding was considered to be a factor, but there was no overcrowding at Delhi, where the turning over of earth in building operations was supposed to have had possibly something to do with the outbreak. The truth is that the disease is present in the general population.

Tubercle of the lungs.—There was a rise in the admission and death-rates from tubercle of the lungs, all the commands except Madras sharing in the rise. Of groups, Gangetic Plain and Hills had much the highest admission ratios; and of commands, Bengal and Punjab the highest death ratios. Six out of the eight highest admission numbers were in Gurkha regiments, and two in Bengal Lancers. The two highest numbers were in the 2nd Battalion, 5th Gurkhas at Abbottabad, and the 1st Bengal Lancers at

Lucknow. No explanation is given with regard to the first, while the tuberculosis of the second is said to have been the result of service in China, especially in Hong Kong. The medical officer of the 43rd Gurkha Rifles at Shillong, and the medical officer of the 2nd Battalion 2nd Gurkhas seems to agree with him, states that Gurkhas have undoubtedly a special susceptibility partly hereditary and partly acquired, the latter being due to absence of domestic cleanliness. To prevent the men infecting their companions and the barrack rooms, immediate reporting of the cases was insisted on, and the early invaliding of hopeless cases to their homes in Nepal. The medical officer of the 2nd Battalion 2nd Gurkas at Dehra Dun mentions defective ventilation as a factor in causation ; and the medical officer of the 1st Battalion of the same regiment at the same place records lessening of the numbers admitted as probably due to improved ventilation.

As non-tubercular phthisis were returned 13 cases with three deaths. This was only about half the number in the previous year, and it is to be hoped that it will be still further reduced in future.

Pneumonia and other respiratory diseases.—Notwithstanding the increase of influenza, there was a fall in both the admission and the death-rate from pneumonia. In 1901, pneumonia caused over 25 per cent. of the total mortality, and was, as usual, the chief cause of death. The admission ratio is usually greatest in Groups VII and XII ; but in 1901, though Group XII occupied the first place, Group VI came second, and Group VII attained only the fourth place. In all these and for India as a whole pneumonia was most prevalent in the cold months, and especially in December and January. Influenza, on the other hand, was most prevalent in February–April. Admission ratios over 50 per 1,000 appeared among the troops employed on the Mahsud Blockade, and at Sibi, Meean Meer, Wana, and Datta Khel ; and death-rates over 20 per 1,000 at Wana, Kherwara, Sirdarpore, Sarwekai, and Datta Khel. The highest number of cases was in the 40th Pathans at Meean Meer, malarial debility being assigned as the predisposing cause, as it was also in the case of the 3rd Sikhs and the 2nd Punjab Infantry at Datta Khel. No cause could be given for the occurrence of the cases in the 28th Punjab Infantry, but it is noted that the type was septicaemic. The cases in the 21st Punjab Infantry were attributed to exposure on the line of march. The 2nd Punjab Infantry had suffered exposure owing to the Mahsud Blockade operations ; and it is noted that the pneumonia of the Tochi Valley is of a peculiarly virulent kind, and that even the battery mules suffered severely from croupous pneumonia. According to Munson, it is a matter of common knowledge that outbreaks of this disease among soldiers often occur at the same time as epidemics of pneumonia or influenza in cavalry horses with which the men come in constant contact.

Other respiratory diseases were most prevalent in the Punjab Command, and in the Burma Inland and Hills groups. The admission rate was high among the troops employed on the Mahsud Blockade. The stations (leaving out, as usual, those with strengths under 100) with admission ratios over 100 per 1,000 were Datta Khel, Wana, and Jandola ; and with death ratios over 5 per 1,000, Sibi and Datta Khel. The 3rd Sikhs at Datta Khel, a place reported to be exposed to sharp cold wind, had much the highest number of admissions ; and the 28th Punjab Infantry at Wana came next. The medical officer of the 33rd Punjab Infantry at Ferozepore attributes the increase to the dustiness of the season from want of rain, and has always noticed that winter rain and pneumonia vary inversely. It is possible that the causation of pneumonia and bronchitis may not be so distinct as is usually supposed, as Gromakowsky reports that he found the pneumococcus in primary chronic bronchitis almost as often as in pneumonia.

Dysentery and diarrhœa.—The admission and death-rates from dysentery in 1901 were low. All the groups had lowered admission ratios, except Burma Coast, Indus Valley, and Southern India ; and the increase in these three was not very great. The troops employed on the Mahsud Blockade had a very high admission ratio, and a considerable mortality. The only stations of over 100 strength which had admission ratios above 100 per 1,000 were Jandola, Sarwekai, Wana, Kajuri Kach, Datta Khel, and Waziribagh, all on the frontier, all without mortality, except Wana and Waziribagh, in the latter of which it reached 4 per 1,000. The admission ratio was also high in Mauritius, the cases occurring mostly in Port Louis. The 23rd Pioneers at Kharab Kot, &c., and afterwards on the blockade had the highest number of cases, ascribed to chills, errors of diet, and bad water. Next came the 17th Bengal Infantry, which suffered from hard work and exposure at Suliman Khel. Dysentery prevailed more in the second-half of the year than the first, the maximum months being December (Mahsud Blockade) and October (as in 1900).

The diarrhœa admission ratio was reduced, and the mortality much reduced. The greatest prevalence was, as in the previous year, in Western Coast. The highest ratio in Western Coast was that of Bombay ; but the ratios of Sibi, Nowshera, Peshin, Wana, and Kajuri Kach were still higher. The only cause mentioned is for Mir Ali Khel, where the sulphates of sodium and magnesium were present in all the water.

Venereal diseases.—While among European troops an average strength of 60,838 gave 16,789 admissions, in the case of native troops an average strength of 122,806 gave only 4,210 admissions. In other words, there were only 34 admissions for every 1,000 men among native troops, against 276 for every 1,000 among British troops. The admission rate for India was 8·2 per 1,000 of strength less than in 1900 : nearly as much below the ratio of 1900 as that was above the ratio of 1899. There were eight deaths and 128 invalidings directly due to venereal disease. Of the commands, Bombay had the highest ratio ; but all the commands had lowered ratios, and the decrease was greatest in the Hyderabad Contingent and Bombay, which had been affected by the diseased famine women in the previous year. Bombay had the highest ratio, of all the commands, from each form of venereal disease. For India the ratio of each form of disease fell.

Beri-beri.—All the 108 cases of beri-beri (against 146) occurred in Madras regiments, 46 in the peninsular part of the command, 49 in Burma, 11 at Colombo, and one each at Singapore and in Mauritius. The 8th Madras Infantry at Rangoon had the highest number of cases, 48 in two separate outbreaks. The medical officer in a long and careful report attributes these to the consumption by the men of impure rice, water in which such rice was washed or boiled, water contaminated by the preceding, or impure rice liquor. In the sediment of the water out of four wells he discovered raw and boiled starch grains, and was about to recommend the use of permanganate of potash for the wells. That one regiment was infected while another escaped, was considered to be due to the dampness and darkness of the kitchens of the former ; that recruits were specially liable to their want of cleanliness in eating ; that Hindus were attacked in greater proportion than Mussulmans, to the frequent washing by the former of their cookhouse floors with cow dung and water. The channel of infection was believed to have been the alimentary canal ; though the possibility of infection through abrasions of the skin, through the lungs, or by the bites of mosquitoes is discussed, as well as the effect of overcrowding and want of ventilation. The writer of the report was probably influenced by the work of Captain Rost, who believes himself to have proved by experiment that rice and its preparations may convey into the human body a bacillus which is the cause of the disease. Sambon also is of opinion that rice may be a vehicle of a specific infection which lives and works within the patient's body. But there are authorities who are equally convinced that rice has nothing to do with the causation of beri-beri. Of these, Manson is the chief, who at the recent meeting of the British Medical Association explained his well-known views at length, quoting the experiences of Travers, Stanley, and Bolton in support of them. He believes that the immediate cause of beri-beri is a toxin produced by a living germ in some culture medium outside the human body ; and that it does not enter the human body in food or water, but is conveyed to man either by the air or through the skin by contact, or by means of some insect or other animal which inserts it under the skin, or by a combination of some of these ways. Direct infection from man to man also has its advocates ; Ross has brought forward some more instances of the presence of arsenic in the hair of early cases of beri-beri ; while Ashmead believes that the disease is due to carbonic acid poisoning and lack of ventilation. Finally, a view very closely related to one of the modern theories of the causation of scurvy has been enunciated by Uchermann in explaining the results of a Norwegian committee of investigation ; namely, that beri-beri is a multiple neuritis due to a toxin intoxication by tainted vegetable or animal food, the vegetable form corresponding to Asiatic beri-beri, and being usually due to the eating of tainted rice. A suspicion has been expressed, apparently with some justification, that the name beri-beri as used by various observers does not always denote one and the same disease.

Jails of India.

Sickness and Mortality in 1901.—The year 1901 was hotter and slightly drier than usual. The monsoon extended inland very slowly, and retreated unusually early. Actual famine was present only in Gujarat and the Deccan; but many of the prisons were still overcrowded. Like the general population, the prison population improved in health in 1901 as compared with 1900.

The chief causes of admission to hospital were ague, dysentery, abscess, and diarrhœa. Among the diseases with raised admission-rates were ague, influenza, abscess, and respiratory diseases other than pneumonia. Ague caused 38 per cent. of the total sickness, and bowel-complaints 17 per cent. The chief causes of death were dysentery, tubercle of the lungs and pneumonia. Among the diseases with lowered mortality were cholera, diarrhœa, dysentery, debility, remittent fever, and pneumonia. Dysentery and diarrhœa caused 27 per cent. of the total deaths, tubercle of the lungs 14 per cent., and pneumonia 13 per cent.

Cerebrospinal fever continued to increase and spread.

Administrations.—The prisoners of Berar, the Central Provinces, the Andamans, Bengal, and Burma, had better health than in the previous year; and the difference was considerable in the case of Berar and the Central Provinces. The most unhealthy administrations were, in order, the Andamans, Bombay, and Bengal; and the three most healthy in order, Burma, Berar, and Madras. Of the former group, Bombay and the Andamans were worse than in the quinquennium. As compared both with the previous year and with the quinquennium, the year 1901 had increase of mortality in the Andamans from tubercle of the lungs and dysentery; in Assam from anæmia and debility; in Bengal from small-pox; in the United Provinces from cholera, tubercle of the lungs, and respiratory diseases other than pneumonia; in the Punjab from dysentery and debility; in Bombay from tubercle of the lungs, pneumonia, and other respiratory diseases; in Berar from remittent fever; in the Central Provinces from non-pneumonic respiratory diseases; and in Madras from tubercle of the lungs. Thus four provinces, just mentioned, had increased mortality from tubercle of the lungs.

Andamans.—The rainfall was more than 49 inches greater than in the previous year, and more than 24 inches over the lustral average. The convict population has been steadily increasing for at least the last five years. The constantly sick and death-rates have decreased during the last three years, but not to anything like the same extent as the corresponding ratios of the troops and police than which they were in 1901 very much higher. Though for the Andamans some of the features are satisfactory (such as the reduction in remittent fever mortality), the crying fact remains that the mortalities from tubercle of the lungs and from dysentery, always an opprobrium of the Settlement, are still increasing. The list of vegetables supplied is very poor in such as are of antiscorbutic value; but the number of admissions from scurvy, though three times greater than in the two preceding years, was not high in proportion to strength. Possibly, however, improvement in the antiscorbutics might lessen the mortality from dysentery. As usual, fever was specially prevalent in the rainy season, the great increase in admissions to hospital coinciding with some very stormy and wet weather which occurred in June and July. There was a great epidemic of malarial fever in the female jail, in which the disease was characterized by its resistance to large doses of quinine, and by the occurrence of three or four relapses of four or five days' duration at intervals of ten to fourteen days, crescents being often very numerous in the blood. Mosquito nets were found more efficacious than quinine. The medical officer, noting the extreme frequency with which intestinal ulceration is met with in fatal cases of phthisis, considers it possible that in some cases the intestinal tuberculosis may precede the pulmonary, and may be grafted on repeated attacks of dysentery. Such a possibility calls for all the more energy in the efforts made to prevent dysentery. That disease was in several instances contracted in hospital from patients suffering therefrom. Measures were accordingly taken for the isolation of the sick, for the destruction of their excreta, and for the supply of boiled water to all prisoners, however far their work might take them from the main supply. These measures were only introduced late in the year, but are said to have been already attended by a considerable amount of success. The sputum and alvine discharges of phthisical patients are also now burnt, as well as the dysenteric stools, in the incinerators; and plans and estimates for a large ward for the isolation of phthisis cases have been called for, and a site chosen. It was time for such measures, as it has been shown above that mortality from tubercle of the lungs and from dysentery

Prisoners.

Administrations.	Years.	Average Strength.*	Ratio per 1,000 of Strength.†										
			Admissions.	Constantly Sick.	Deaths from								
					Cholera.	Remittent Fever.	Tubercle of the Lungs.	Pneumonia.	Other Respiratory Diseases.	Dysentery.	Diarrhœa.	Anæmia and Debility.	All Causes.
Andamans	1896–1900	10,975	1,689	51	—	3·17	5·50	2·48	1·02	10·04	2·26	2·00	32·31
	1900	11,580	2,039	54	—	4·92	5·70	4·75	1·04	9·67	4·23	3·54	40·41
	1901	12,183	1,683	51	—	2·87	6·57	4·10	·98	11·98	2·05	·08	36·94
Burma	1896–1900	13,127	626	30	2·00	·44	3·84	2·04	·43	4·27	·90	·46	20·54
	1900	12,516	556	28	1·76	·40	4·87	1·60	·24	3·91	·80	·56	21·17
	1901	11,840	551	26	1·44	·17	4·31	1·18	·25	2·28	·17	·17	15·29
Assam	1896–1900	1,284	961	49	4·67	2·65	1·40	2·65	1·71	8·88	4·05	3·58	44·24
	1900	1,314	769	37	·76	1·52	2·28	3·04	·76	6·85	·76	1·52	25·88
	1901	1,338	1,022	45	·75	2·99	—	·75	·75	5·98	2·99	3·74	26·16
Bengal	1896–1900	18,121	1,067	37	2·40	·96	3·77	3·60	·91	7·76	1·57	·96	30·11
	1900	19,593	1,156	40	4·44	·82	5·05	4·29	1·22	9·44	2·50	1·22	39·61
	1901	20,149	1,090	39	·89	·35	3·72	2·83	·74	8·14	1·09	·40	27·59
United Provinces of Agra and Oudh.	1896–1900	32,128	883	45	·47	·47	2·71	4·86	1·00	6·09	2·04	2·66	27·86
	1900	31,083	764	36	·32	·32	2·73	3·64	·55	4·47	1·29	·93	22·10
	1901	29,311	840	40	1·13	·07	3·68	2·46	1·19	5·87	1·23	·48	24·29
Punjab (*a*)	1896–1900	12,081	1,253	33	·23	·55	2·83	4·87	·74	3·24	·96	·36	19·83
	1900	14,196	1,270	38	·92	·21	3·94	5·56	·70	4·79	·70	·49	24·58
	1901	13,469	1,251	38	—	·45	3·04	5·12	·45	4·68	1·04	1·11	27·03
North-West Frontier Province.	1896–1900	1,178	1,225	41	—	1·87	·68	4·24	1·02	2·21	1·87	—	19·35
	1900	1,354	812	32	—	·74	1·48	1·48	—	1·48	2·22	—	14·77
	1901	1,248	953	30	—	—	—	4·81	·80	4·01	—	—	22·44
Bombay	1896–1900	8,759	773	29	3·27	2·44	2·74	6·12	1·35	3·27	3·04	1·46	33·72
	1900	11,495	784	28	5·92	3·31	3·65	6·70	1·30	5·22	4·52	2·87	46·80
	1901	10,270	994	37	—	1·56	3·80	10·02	1·95	2·63	1·85	1·46	36·12
Berar and, Secunderabad.	1896–1900	1,659	637	19	1·93	·36	1·57	5·30	4·10	6·75	2·89	3·25	36·05
	1900	1,927	943	26	6·75	—	2·59	11·42	6·23	20·76	9·86	2·08	79·92
	1901	1,483	676	20	—	·67	2·02	6·74	3·37	2·02	·67	2·70	24·95
Central Provinces ...	1896–1900	5,583	1,072	45	3·51	1·22	4·12	5·30	1·40	30·49	9·78	5·02	74·23
	1900	5,728	926	30	7·68	1·40	4·36	4·02	1·05	19·90	9·43	5·76	68·44
	1901	4,802	864	29	—	—	2·50	3·12	1·46	7·91	4·79	2·29	27·49
Madras	1896–1900	8,870	646	27	5·30	·14	3·56	2·37	·54	4·10	·05	·34	28·30
	1900	10,135	521	22	1·97	·30	3·65	2·27	·20	3·85	·20	·59	24·67
	1901	10,456	593	25	3·54	·10	4·11	2·10	·10	2·87	—	·29	23·34
India‡	1896–1900	114,293	981	38	1·68	1·03	3·35	4·02	·94	7·04	2·10	1·67	29·97
	1900	121,811	977	35	2·28	1·21	3·95	4·22	·86	6·79	2·45	1·58	32·80
	1901	117,203	981	37	·90	·65	3·86	3·61	·93	5·85	1·34	·71	26·87
	1891–1900	108,606	1,024	39	1·99	1·20	2·98	4·27	1·09	6·81	2·18	1·78	30·29

* The quinquennial and decennial ratios are, of course, worked on the total strength of the lustrum and decade respectively.

† Excluding subsidiary jails.

‡ Including Ajmer, Quetta, and Mercara.

(*a*) Excluding jails transferred to North-West Frontier Province.

was higher than the quinquennial average and higher than in 1900. Epidemics of mumps and of influenza occurred.

Burma.—The information afforded by the Inspector-General as to the health of his prisoners is extremely meagre. Overcrowding to a slight extent took place in the jails at Prome, Henzada, and Myanaung; but was quickly relieved by transfers to other jails. As in the previous year, the health of the prisoners was very good, and the death-rate was the lowest on record. But the scurvy admission-rate was higher than in any other province, and the cholera mortality was lower only than that of Madras. An epidemic of 20 cases of cholera with 12 deaths in the Insein Central Prison was referred to infected tobacco introduced by a prisoner sent in from a police lock-up without any intimation that he had for some time been in intimate contact with cholera cases. The origin of the four cases in the Paungdi jail was not traced, but cases were occurring within three furlongs of the jail. The admission-rate of Burma for tubercle of the lungs was above that of India. Of the convicts admitted into jail, over 14 per cent. confessed to the habitual use of opium.

Assam.—Though the ratios were somewhat higher than in the preceding year the health of the Assam prisoners, like that of the general population, was, on the whole, good. There was diminished mortality from pneumonia, dysentery, and cholera; and increased mortality from diarrhœa and remittent fever. Very little useful information, outside of tables, is to be obtained from the administration report. The origin of the single case of cholera, in the Cachar jail, was not traced. Assam had the highest mortality ratios from malarial fevers and from debility, and high mortality ratios from dysentery and diarrhœa; but it had no mortality from tubercle of the lungs, and the lowest admission ratio from the same.

Bengal.—The health of the Bengal prisoners improved, as did that of the general population. All the ratios given are favourable in 1901, except that the smallpox mortality ratio was higher than that of the preceding year and quinquennium and the dysentery ratio higher than that for the lustrum. Overcrowding could "usually" be obviated by the use of temporary buildings and factories (an unsatisfactory device), or by transfer of prisoners, and building operations are in progress which will add largely to the jail accommodation. The Berhampore jail has been connected with the municipal water-supply, and the Midnapur jail is also getting a pipe-supply; but the eight Pasteur-Chamberland filters in the jails of the province are reported to be very liable to get out of order, and not to have proved a great success. Influenza was present in a number of the jails. At Bankipore the first prisoner attacked by cholera was a convict on outdoor labour; at Monghyr the first two cases were those of prisoners working outside who were believed to have got contaminated milk from a passer-by; and at Muzaffarpur and Hooghly the origin of the disease could not be traced. The results of the treatment of dysentery by izal were on the whole not encouraging. The dysentery of the Midnapur Central and Barisal jails was connected, in the opinion of the Inspector-General, with a deficient supply of fresh vegetables. Plague occurred in three jails, the most at Bankipore. Most of the cases of cerebrospinal fever appeared in the Bhagalpur Central Prison, but six other jails returned the disease. It is noteworthy of itself and in connexion with what was said under the head of the Andamans, that in four of the fatal cases of "dysentery" at Hooghly advanced tubercle of the lungs was found. In the Alipore Central Prison the prevalence of tubercle of the lungs was attributed to overcrowding and defective ventilation, and the measures taken in consequence are considered to have already met with some success. Modern scientific arrangements have been made in some jails for the treatment of the tuberculous sick and the protection of others.

United Provinces.—Though the year was described as healthy, and the health of the general population as good with a slightly diminished mortality, the health of the prisoners was not so good as in the previous year. There was greater mortality from tubercle of the lungs, dysentery, and heatstroke; and there were fatal epidemics of cholera and cerebrospinal fever. Transfers on account of overcrowding were not so frequently necessary as in 1900. Efforts were made, as far as funds permitted, to improve the water-supply in the jails; and the supplies of the Lucknow and Benares Central and of the Jaunpur and Moradabad District jails are mentioned as requiring attention. The Benares District Jail is being connected with the municipal water-supply, but is not considered likely ever to be a healthy jail. Influenza was present in many of the jails; and cerebrospinal fever in five, that most severely affected being the Allahabad District Jail. Except in the Lucknow jails, cholera was successfully stamped out after

the occurrence of a single case. The outbreak at Lucknow appeared to be part of a general epidemic which affected the city, the cantonments, and all the villages round the jails most severely, long before a case appeared in the jails. No proof of the introduction of the disease by flies or in any other way was obtained. One result of the prisoners having to be in cholera camp in the rains was a high mortality from dysentery. The requisite accommodation for the isolation of dysentery patients was not always at hand, but increased attention was given to the destruction of their evacuations. The Inspector-General believes that "dysentery" is in many cases merely a terminal symptom of malarial cachexia and not due to specific dysenteric infection. But it would not be safe to act upon that belief, especially as it is quite as likely that a malarial cachectic may be an unusually easy prey to a dysenteric infection. A special ward for the treatment of tubercle of the lungs was erected in a large open space in the Agra Central Prison, and it is intended to provide similar wards in other jails. Meanwhile, open-air treatment and isolation are adopted whenever possible.

Punjab.—In the Punjab also the standard of health of the prisoners was lower than even in the previous year, though the health of the general population was, on the whole, improved. It may be noted, however, that seven out of the ten district jails with highest mortality were in districts stated by the Sanitary Commissioner to have had high mortality among the general population. Other explanations attempted by medical officers from purely local points of view were, with right, not considered satisfactory by the Inspector-General. The mortality ratios from tubercle of the lungs, pneumonia, and dysentery, though improved, were still high, while that from diarrhœa was higher than before. There was a good deal of pressure on the accommodation, but crowding was avoided by pitching tents outside the jail walls as far as practicable. Four jails have already received, and two more are about to receive, a piped water-supply. The distribution by hand in other jails is a danger to the purity of the otherwise generally satisfactory drinking water. During the year efforts were made to improve the personal hygiene of the prisoners, and the Allahabad system of filth disposal was introduced into most jails with success. In addition to the quinine prophylaxis of malaria, special attention was given to drainage and the disposal of spill-water, and steps were taken to fill up excavations in the neighbourhood of jails; but in these respects much remains to be done. In 13 jails there was no mortality from dysentery, but on the whole it caused a high mortality; and the Inspector-General rightly emphasizes the necessity for carefully detailed measures based on the belief that the disease is infectious. He considers also that one of the chief causes of pneumonia in jails is the habit of wrapping the head in the bedding during sleep. A special isolation ward in the Lahore Central Prison was sanctioned for the treatment of tuberculous patients; and elsewhere modern treatment was adopted as far as practicable. There was an outbreak of cerebro-spinal fever in the Mung Rasul Central Prison.

North West Frontier Province.—The jails of Peshawar, Kohat, Bannu, Dera Ismail Khan, and Abbottabad did not come under the administration of the new province till the 9th of November, 1901; but for convenience it was ordered that they should be taken as in that province the whole year; and for the same reason the quinquennial figures are given in the table. There was a considerable increase of mortality. Some of this was due to heatstroke, not always inside the jails; but there was also comparatively high mortality from smallpox, pneumonia, and dysentery. There was no cholera and no mortality from tubercle of the lungs. The chief cause of sickness was malaria, against which prophylactics were issued in the autumnal months.

Bombay.—Though the sick ratios increased, the prisoners of Bombay had, like the free population, a considerably reduced mortality. Famine was present only in Gujarat and the Deccan. Among the prisoners there was a substantially lowered mortality from bowel-complaints, but increased mortality from tubercle of the lungs and from respiratory diseases, especially pneumonia. All the jails except three were overcrowded, and work-sheds and tents had to be used. The latter, when pitched outside the jail, are far preferable. Eight out of twelve overcrowded jails had a mortality over 33 per 1,000, and the tubercle in the House of Correction was suspected to be due to the overcrowding. Wherever necessary, special issues of food, clothing, and fever prophylactic medicine were made. There was no cholera. In the Bombay Common jail, nine deaths took place from relapsing fever, a disease which also occurs in the city outside the jail. One death from cerebro-spinal fever was returned in September from the Ahmedabad Central Prison.* Cases of

* An outbreak followed in February, March, and April, 1902; and the free population was also said to be affected at that time.

plague occurred in five jails. There was much sickness and mortality from pneumonia in the Sind Gang and a good deal in the Ahmedabad Central Prison; and the Bombay administration had the highest pneumonia mortality ratio.

Berar.—The general population of Berar is described as having been unusually healthy and free from epidemic disease, the aged and weakly having succumbed to the late famine. The health of the prisoners also greatly improved, and might "be described as normal." But tubercle of the lungs and pneumonia mortalities were still above their lustral ratios. An epidemic of influenza occurred in the Amraoti Central Prison. In Akola ankylostomiasis used to be mistaken for scurvy; and since the true nature of the disease was recognised, sickness and mortality from it have been diminished.

Central Provinces.—The population of the Central Provinces was healthier than in the preceding year, and the ratios for the prisoners were much improved, especially those of mortality. There were no deaths from cholera, small-pox, or remittent fever; and the ratios of death from tubercle of the lungs, pneumonia, dysentery, diarrhœa, and debility were reduced. But the Central Provinces was the administration that had the highest death-rate from diarrhœa, the mortality from respiratory diseases other than pneumonia was higher than in 1900, and cerebrospinal fever occurred in two jails. There was not so much difficulty as in the foregoing year about overcrowding. It is stated, however, that four jails had generally more prisoners than sleeping barracks were meant to contain; but that the excess was satisfactorily housed in the worksheds at night; and that extramural camps were not necessary to relieve overcrowding. This use of worksheds cannot be called satisfactory from a sanitary point of view. The Punjab rule is a sound one that excess prisoners must be placed in tents outside the jail, unless special permission is obtained to treat them otherwise. The Jubbulpore Central Prison, with low admission and constantly sick rates, had high mortality, chiefly from bowel-complaints. The frequent occurrence of gangrenous dysentery in this jail has not been satisfactorily explained, and the matter is under investigation. Special inquiry should be made as to the nature, quality, issue, and cooking of the food.

Madras.—Though the prisoners of Madras had higher ratios of sickness than in the previous year, their mortality was, like that of the general population, lower. There was greater mortality from cholera and tubercule of the lungs, but less from pneumonia and dysentery. Six jails were overcrowded, the excess being accommodated in workshops and temporary sheds, or removed by transfer. The use of workshops for the purpose is objectionable (See under Central Provinces); and temporary buildings should not be erected within the jail enclosure wall, unless there is legitimate space for them. Cholera appeared in three central and five district jails; and evacuation, partial or complete, was in every case attended with the best results. In the case of the Vellore Central Prison the disease was restricted to a batch of new arrivals, and the great value of extramural quarantine was proved. The exact manner of introduction into jails was not traced in any case, though flies, rise of subsoil water, and disturbance of cholera-burial-ground soil are mentioned in connexion with causation. The first case at Berhampore occurred in a man who had attended the Sessions Court four days before. The Berhampore water had been pronounced suspicious, and was boiled before use. The prisoners continued to use the jail water after going into camp, a very risky thing to do; but no more cases occurred. An attempt, not very clear, is made by the medical officer to explain why there were so many cases of malarial fever in the Rajamundry Central Prison in 1901, but he does not explain why there were so many more than in the preceding year. Dysentery was also prevalent in the same jail, and was not stopped by antimalarial prophylaxis or by permanganating the water; and the treatment by izal was not found very satisfactory. The Trichinopoly Central Prison returned not only 30 admissions and 6 deaths from tubercle of the lungs, but also 40 admissions and 16 deaths from tubercle of the intestines. This seems to call for serious investigation. The Inspector-General doubts the diagnosis in at least some of the cases; and the medical officer gives no special explanation, though he mentions that his jail might be called a convalescent depôt, and recommends the provision of a special tubercule ward. In 1900 the same jail returned 19 cases of tubercle of the intestines.

Coorg. Rajputana. Baluchistan.—The Mercara jail was much less healthy than in the previous year, the death-rate being more than three times as great. No less than nine deaths from diarrhœa and three from debility took place in this small jail. No explanation is given. The Ajmer jail was much more healthy than in the preceding year of famine, there being a great reduction in dysentery mortality, and the ratios in general approaching more nearly to the normal of the quinquennium. The Quetta statistics were less favourable than in 1900.

The General Population.

Census of 1901.—The third general census of India was taken on the night of the 1st of March, 1901. The populations of the whole Empire were enumerated, except those inhabiting West Manglün, the trans-Salween Northern Shan States, and certain tracts of the Baluchistan Agency. Although the area of the operations was nearly sixteen hundred thousand square miles, and the number enumerated close upon three hundred millions, the preliminary results were declared within a fortnight. A result of this triumph of organisation is the use in the provincial Sanitary Reports for 1901 of the new census figures.

The total population enumerated was 293,475,477, an increase of 6,079,483 or 2·1 per cent. over the population of 1891. But 2,293,629 of the increase is due to the inclusion of territories not included in 1891, so that the actual increase during the ten years of the populations enumerated in that year was 3,785,854, or 1·3 per cent. In the following table the facts are set forth in detail.

British Provinces and Native States.		Population (1901).	Population (1891)	Increase or decrease (+ or −).		Population of area not included in 1891 census.	Increase excluding area not included in 1891 census.	
					Per cent.			Per cent.
Bengal	British ...	74,744,866	71,346,961	+3,397,905	4·8	—	—	—
	Native States	3,748,544	3,326,837	+421,707	12·7	—	—	—
Assam	British ...	5,841,378	5,477,302	+364,576	6·6	—	—	—
	Native States	284,465	—	+284,465	100·0	284,465	—	—
United Provinces of Agra and Oudh.	British ...	47,691,782	46,904,791	+786,991	1·6	—	—	—
	Native States	802,097	792,491	+9,606	1·2	—	—	—
Panjab and North-West Frontier Province.	British ...	22,455,819	20,866,847	+1,588,972	7·6	74,756	1,514,216	7·2
	Native States	4,424,398	4,263,280	+161,118	3·8	—	—	—
Central Provinces	British ...	9,876,646	10,784,294	−907,648	8·4	—	—	—
	Native States	1,996,383	2,160,511	−164,128	7·6	—	—	—
Berar		2,754,016	2,897,491	−143,475	4·9	—	—	—
Madras	British ...	38,199,162	35,630,440	+2,568,722	7·0	—	—	—
	Native States	423,904	419,980	+3,924	0·9	—	—	—
Coorg		180,607	173, 55	+7,552	4·3	—	—	—
Bombay	British ...	18,515,587	18,834,235	−318,648	1·7	—	—	—
	Native States	6,908,648	8,082,107	−1,173,459	14·5	—	—	—
Burma	Lower ..	5,645,673	4,658,627	+987,046	21·2	—	—	—
	Upper ...	3,607,202	3,063,426	+543,876	17·8	—	—	—
	Native States	1,237,749	—	+1,237,749	100·0	1,237,749	—	—
Ajmer-Merwara		476,912	542,358	−65,446	12·0	—	—	—
Kashmir		2,905,578	2,543 952	+361,626	14·2	—	—	—
Rajputana		9,723,301	11,990,504	−2,267,203	18·9	—	—	—
Central India		8,623,781	10,318 812	−1,690,031	16·3	—	—	—
Hyderabad State		11,141,142	11,537,040	−395,898	3·4	—	—	—
Mysore*		5,539,399	4,943,604	+595,795	12·1	—	—	—
Baroda		1,952,692	2,415,396	−462,704	19·1	—	—	—
Baluchistan		810,746	27,270	+783,476	2873·0	696,659	86,817	318·4
Andamans		24,499	15,609	+8,890	57·0	—	—	—
Gwalior State		2,933,001	3,378,774	−445,773	13·2	—	—	—
Total, India		293,475,477	287,395,994	+6,079,483	2·1	2,293,629	+3,785,854	1·3

* Including the Civil and Military Station of Bangalore.

Alterations in the numbers of the populations. Relation to rainfall.—In seven of the British provinces there was an increase of the population ranging from 21·2 per cent. in Lower Burma and 7·6 per cent. in the Panjab (including the North-West Frontier Province), to 1·6 per cent. in the United Provinces. In the remaining four British provinces the populations declined at rates varying between 1·7 per cent. in Bombay and 12·0 per cent. in Ajmer-Merwara.

The changes in the numbers of the population in different parts of the country during the last ten years furnish a striking illustration of the close dependence of the Indian peoples upon a sufficient and normally distributed rainfall.

The monsoon rainfall was in serious defect (—4·76″) over the whole of northern and central India in 1895, and in the following year the defect over the same areas was even greater (—5·33″). In 1899, although the monsoon rains were unusually heavy in Assam, Bengal, and Bihar, they completely failed (—11·14″) over north-western and western India and the Deccan. In several years also the autumn and cold weather rains were deficient.

If a map showing the parts of the country where the population has increased and decreased is examined, it will be found that the areas in which the most serious decrease occurred may be enclosed in an irregular quadrilateral described by lines joining the following points; the north-west corner of Cutch, the extreme north of Rajputana, the south-east of the Central Provinces and the south of the district of Belgaum. This figure includes, particularly in the south, areas in which there has been an increase in population, while it excludes areas where there was a decrease; but the increase in the included areas may depend in some cases on the rainfall not having been seriously deficient, while the decrease in the excluded areas seems to be due in many cases to an excess of rain rather than to a deficiency. Nearly the whole of the quadrilateral depends for its main supply of rain on the south-west monsoon current from the Arabian Sea, although parts in the north of the figure receive rain from the Bay current.

The southern border of the area of decreased population follows more or less closely a line to the south of which the autumn rainfall is normally over five inches. Taking the total rainfall of the decennium, the amount discharged by the south west monsoon was in defect in the greater part of Bombay, Rajputana, Central India, the Central Provinces, the north and east of Madras, Eastern Bengal, Assam and Upper Burma; while the discharge from the north-east monsoon was in defect in much the same areas, and also in Sind and Lower Burma.

The ten years may be divided into two periods; the first from April, 1891, to March, 1895, when the rainfall over a great part of the country was in excess; the second from April, 1895, to March, 1901, when the rainfall was in great defect. The area in which there was a great excess in the first period corresponds fairly closely with the area in which there was a great deficiency in the second period; but in both periods there was a deficiency over the coast districts of Bombay, in the north and west of Madras, in part of Eastern Bengal, Assam and Upper Burma; and in both periods there was excess in the extreme north-west of the Panjab, in certain northern and south-eastern districts of the United Provinces, in the north-western districts of Bengal and in deltaic Burma.

But the effects of epidemics on the population must not be overlooked. The relationship between cholera prevalence and rainfall is a complex one, and probably varies in different parts of the country and at different seasons of the year. Among several severe cholera years, the decennium includes three in which the mortality recorded was unprecedented. In 1891 the number of deaths recorded from cholera in the British provinces was 581,409, in the following year the number rose to 724,348, and in 1900 it was 809,179. The aggregate number of deaths recorded in the ten years was 4,505,019, of which 1,970,833 were registered in Bengal, 814,659 in the United Provinces, 619,956 in Madras and 391,430 in Bombay—in the case of the last named a number greater than the decrease in the population during the decennium. A new cause of mortality was also at work, for although the number of deaths registered as due to plague up to the end of 1900 was a little less than a fourteenth of the number ascribed to cholera during the decennium, the disease had obtained a firm hold in only a few of the provinces. In Bombay the number of recorded deaths from plague, from 1896 to 1900, was 265,912, only 3,437 less than the number recorded as due to cholera in the same period, which includes 1900, a year of unparallelled cholera mortality in Bombay.

In the vast area of an Indian province the conditions of race, climate and environment vary so much that it would be surprising if the results obtained in particular districts were always in conformity with those obtained in the province generally.

In most provinces in which the population increased, there were districts where it diminished, and in most provinces where the population diminished there were districts where it increased. In Madras the population increased in every district; but in Coorg the population of the district of Padinalknad decreased.

In Bengal the populations of seven districts decreased. In Patna, Gaya and Saran the main cause of the decrease was mortality from plague, but in the cases of Gaya and Saran the census operations were partially disorganised by the presence of plague, so that there is some uncertainty about the actual numbers of the people. Champarun and Shahabad suffered severely in the lean years and were very unhealthy; while the districts of Purnea and Jessore were unhealthy throughout the decennium. In every one of those districts except Jessore the rainfall in both periods of the decennium was in excess. In Jessore the rainfall in the second period was in excess.

In Assam the populations of two districts declined; Nowgong, where *kala azar* was very severe, and emigration increased while immigration decreased; and Kamrup, where, in spite of the gradual disappearance of *kala azar*, the public health was bad and there was a good deal of emigration.

In the United Provinces no less than 18 districts shew a falling off in population, the amount varying between 11·5 per cent. in Azamgarh and ·3 per cent. in Rai Bareli. Most of these districts are in the south and east of the province, and the recorded deaths exceeded in number the recorded births in most of them in 1891, 1894 and 1897, and in some of them in 1895 and 1896. Here we have to do with the effects not only of drought in certain seasons but of too much rain in others, for the mortality in the districts in the Eastern plain and in the Eastern and Western Sub-Himalayan tracts is stated to have been due to diseases induced by excessive rain, which probably did more damage to the crops in these districts than drought.

In the Punjab the population declined in seven districts, Montgomery in the south and the six districts which run continuously along the north of the province from Umballa in the east to Jhelum in the west. The cause of the decrease in Umballa is obscure, but appears to have been general "unhealthiness." In the cases of the other districts the people emigrated to more favoured parts of the country.

In the Central Provinces most districts suffered severely from famine and the effects of famine, but the fall in the numbers of the population was aided by the emigration of between 150,000 and 200,000 people. mostly to the tea districts of Assam, but partly also to Berar, where prior to 1900, conditions were more favourable to agriculture than in the Central Provinces. In three districts the population increased. Sumbalpur, in the east of the province, depends for rain upon the current from the Bay of Bengal and suffered but little from drought; Nimar, which increased by 14·4 per cent., received immigrants from Khandesh, Berar and the adjoining native territory. Chhindwara, where the increase was very small, received emigrants from the *jagirs*.

In Berar the population of Akola increased. There was immigration into the district, but the actual increase is among the female population and is attributed to their more accurate enumeration.

In Bombay, the population of the province of Sind increased by 11·7 per cent., and in the districts of Ratnagiri, Dharwar, Kanara, and Kolaba the populations increased. In Sind, agriculture depends upon irrigation, and plague was less prevalent than in the Presidency. The districts of Ratnagiri and Kolaba supply the labour market of the capital, and the increase in their populations may be due to exodus from the latter.

Results of registration.—The following table (*see* page 80) exhibits the excess or defect of the populations determined by the census of 1901 as compared with the same populations in 1891, and also shews the results of registration.

A word of explanation regarding the figures in the table is necessary. While the areas under registration are always included in the areas of the census operations, the areas do not generally quite coincide. The population for which vital statistics are registered is in most cases slightly less than the population enumerated at the census. The figures in columns 2 and 3 are, therefore, not comparable, but the percentages in columns 4 and 5 are comparable. In the figures representing the results of registration no account is taken of emigration or immigration; *e.g.*, Assam receives large numbers of emigrants from the United Provinces and the Central Provinces; and from these and from other provinces, there is a considerable flow of emigration to places out of India.

Province.	Total Variation (1891–1901).		Variation per cent.		Inclusion of Additional Area per cent.
	Census.	Births minus Deaths.	Census.	Births minus Deaths.	
(1)	(2)	(3)	(4)	(5)	(6)
Lower Burma	+ 987,046	+ 303,626	+ 21·2	+ 6·8	—
Panjab and North-West Frontier Province.	+ 1,588,972	+ 1,387,408	+ 7·6	+ 6·8	+ 0·4
Madras Presidency	+ 2,568,722	+ 2,385,303	+ 7·0	+ 7·2	—
Assam	+ 364,576	— 126,915	+ 6·6	— 2·5	—
Bengal	+ 3,397,905	+ 2,050,418	+ 4·8	+ 2·9	—
Coorg	+ 7,552	— 12,510	+ 4·3	— 7·2	—
United Provinces of Agra and Oudh	+ 786,991	+ 2,382,283	+ 1·6	+ 5·1	—
Ajmer-Merwara	— 65,446	— 54,614	— 12·0	— 10·1	—
Central Provinces	— 907,648	— 380,180	— 8·4	— 4·0	—
Berar	— 143,475	— 150,803	— 4·9	— 5·4	—
Bombay Presidency	— 318,648	— 241,547	— 1·7	— 1·3	—
Total India	+ 8,266,547	+ 7,542,469	+ 3·8	+ 3·5	—

It will be observed that in Madras and Bombay the results of registration appear to agree very closely with the results of the census; but this appearance of agreement is misleading. In Madras both the birth-rates and death-rates are very low, and both are very much lower in the country than in the towns; while if the district figures are examined separately, it will be found that the registration and census figures do not agree. Thus, in the presidency town the registration figures shew a decrease of the population of 1·2 per cent., while the census shews an increase of 12·6 per cent. In twelve of the districts the census totals are higher than the registration totals, the excess ranging from 0·1 per cent. of the population in Kurnool, to 5·7 per cent. in Godavari and 9·6 per cent. in the Nilgiris. In 10 districts the excess of births over deaths is higher than the census totals, the difference varying between 0·1 per cent. in Salem and 4·9 in Nellore.

In Bombay the agreement between census and registration results disappears when the figures for the Presidency proper and Sind are taken separately. In Bombay the census shews a decline of 4·10 per cent. and registration a decline of 2·03, while in Sind the population has increased by 11·68 per cent., although the increase shewn by the registration figures is only 2·88 per cent.

Registration, 1891–1900.—The following paragraphs contain a brief analysis of the figures registered during the 10 years ending with 1900.

Birth-rates.—Making allowance for a rise in the population in most provinces, and for a fall in a few, and for the effects of famine and plague, a study of the birth-rates recorded in the nine years ending with 1900 seems to shew that registration is improving slowly but surely. The range between the highest birth-rate recorded, 50·5 per 1,000 in Berar in 1899, and the lowest, 14·67 in Ajmer-Merwara in 1900, is very wide, rates are consistently low in Madras (extremes 25·1—31·8) and Coorg (16·15—26·62), and do not shew much signs of improving, and rates in Bombay (26·87—36·76) under the stress of accumulated misfortunes are declining; but in Burma the rise in the rates has been almost continuously progressive from 24·83 per 1,000 in 1892 to 38·37 in 1900; and in Bengal (extremes 28·15—42·96), Assam (28·59—35·45), the United Provinces (31·10—48·09) and the Panjab (34·02—48·4), the rates tend to be higher towards the

end of the period. In the Central Provinces (26·85—47·35) the low rates recorded between 1895 and 1898, inclusive, and in Berar (31·3—50·5) the low rates of 1898 and 1900, are due to the years of famine.

The highest rate recorded in 1891 was 43·09 in the Central Provinces; in 1892 the highest rate was 39·9 in Berar; in 1893, the highest rate was 40·95 in the United Provinces. In all other years, save 1899,—a year of high rates, when 50·5 was registered in Berar, 48·4 in the Punjab, 48·09 in the United Provinces and 42·96 in Bengal—the Punjab headed the list, the rates varying between 43·9 in 1894, and 41·0 in 1898.

Proportion of the sexes at birth.—The provincial figures showing the proportions of the sexes at birth present remarkable features, and would be of great interest if it was possible to discriminate between the peculiarities due to race and environment and the peculiarities due to imperfect and wrong registration.

During the fifty years ending with 1900, the highest percentage of male to female births recorded in England and Wales in any year was 105·2 in 1857, and the lowest 103·2 in 1898, so that the variation between the extremes was only 2 per cent. If, however, separate counties are taken, the variation is much greater. In 1900 the highest percentage was 112 recorded in Westmoreland, and the lowest 96·1 in Herefordshire; and both these figures indicate a considerable departure from the average, which for the 10 years ending 1899 was 101·4 in Westmoreland, and 102·9 in Herefordshire.*

The Indian provinces, with two exceptions, shew far higher percentages than England and Wales, and some of them shew greater variations from year to year than the English counties, but the figures registered in each province are generally fairly characteristic.

The provinces may be grouped in four divisions. Those in which the percentages were low, the average for the 10 years ending 1900 being below 105; those in which the percentages were moderate, average between 106 and 108; those in which they were high, average 108 to 110; and those in which the percentages were extremely high, above 115.

To the first division belong only two provinces, Coorg (average 101·2) and Madras (104·4). To the second belong six, Bombay, excluding Sind (106·2), the Central Provinces (106·4), Bengal (106·5), Berar (106·6), Lower Burma (107·4) and Assam (107·6). High percentages were recorded in the United Provinces (108·9) and the Punjab, excluding the Peshawar and Derajat Divisions (110); and extremely high percentages in Ajmer-Merwara (116·8), the Peshawar and Derajat Divisions (121·9) and Sind (124·3).

That unduly high percentages of male to female births are the result of wrong classification rather than omission to register is evidenced by the fact that these percentages have gradually declined in the different provinces out of proportion to the rise in the birth-rates. There seems, however, to be good reason to believe that as we recede from the sea into dry climates where the variations of temperature are extreme, the proportions of male to female births increase.

The variations between the highest and lowest percentages registered during the 10 years are of interest.

Here again the provinces may be placed in four groups; where the variation was very small, Bombay (·8 per cent.) and Madras (·9); where the variation was small, Berar (2·1), the Central Provinces (2·47), Assam (2·87), Bengal (3·0) and Burma (3·0); where the variation was considerable, Sind (3·4), the Punjab (4), the United Provinces (4·46); and where the variation was very great, Coorg (11·54), Peshawar and Derajat Divisions (12·3) and Ajmer-Merwara (19·46).

It may be remarked that the population of Coorg is only 180,401; and that in three of the ten years the percentage of male to female births was below 100, the lowest being 95·80, registered in 1899. The extreme variation in Ajmer-Merwara seems to be due to bad registration. The constancy of the high percentage recorded in Sind is certainly remarkable.

Death-rates.—Excepting the United Provinces, Madras and the Punjab, the highest mortality in every province recorded during the 10 years ending with 1900 occurred in one of two years, 1897 and 1900. In the former year the highest death-rates were

* Annual Report of the Registrar General, 1900, page liii & lx.

registered in Assam (50·61), the Central Provinces (69·34), Madras (25·4) and Coorg (50·03); while exceptionally high rates were registered in the United Provinces, Berar and Bombay. In 1900 the greatest mortality was recorded in Bengal (36·63), Berar (82·7), Bombay (70·07), Ajmer-Merwara (119·97) and Lower Burma (27·51); while high rates were registered in the Punjab, the Central Provinces and Coorg. In the United Provinces the highest rate was 42·51, registered in 1894, when cholera was very severe and fevers unusually deadly. In the Punjab the high rate recorded in 1900 follows closely the maximum (49·48) recorded in 1892, when there was the severest epidemic of cholera since 1867, and fevers, including a wide-spread epidemic of influenza, were extraordinarily fatal. In Assam (29·91), Coorg (21·79), Ajmer-Merwara (20·23) and Lower Burma (15·93) the lowest death-rates were registered in 1891. In Coorg the census of 1891 showed that there had been a material decrease in the population, so that the rate in that year was computed on too large a population. In Lower Burma the rates have increased fairly steadily from year to year. In all the other provinces the minima were recorded in 1893 or 1898. In the former year the lowest rates were returned from the United Provinces (24·10), the Punjab (28·13), Madras (19·3) and Bombay (27·20); in the latter from the adjoining provinces of Bengal (26·57), the Central Provinces (24·30) and Berar (23·4).

Death-rates of sexes at different ages.—The following table shows, but, unfortunately, not with complete accuracy, the average death-rates at each age period among the two sexes in the British provinces.

Mean ratio of deaths during 1891–1900.

Province.	Under 1 year.		1-5 years.		5-10 years.		10-15 years.		15-20 years.		20-30 years.		30-40 years.		40-50 years.		50-61 years.		60 years and above.	
	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.
Lower Burma	236·61	167·01	33·15	28·19	13·26	11·11	8·26	7·33	11·48	9·95	12·50	12·78	16·89	18·02	21·44	18·49	29·12	23·89	60·71	58·48
Assam ..	191·14	174·79	38·81	37·57	19·28	16·05	17·51	16·81	25·25	27·99	24·43	26·23	27·81	26·84	34·48	27·72	47·75	41·23	78·44	61·94
Bengal ..	223·33	181·08	44·01	38·53	18·74	15·32	14·71	12·26	18·44	17·45	20·61	18·01	22·60	18·83	29·89	23·12	42·74	36·51	81·05	63·07
United Provinces.	256·60	238·04	55·85	54·19	13·78	11·97	8·65	8·17	11·92	16·21	15·90	16·03	20·28	17·26	30·79	25·69	49·47	38·59	68·78	48·22
Punjab ..	221·03	219·19	60·15	64·92	12·23	13·17	8·47	10·02	9·25	11·03	11·02	13·40	15·75	17·40	24·07	22·18	37·48	33·12	108·34	109·58
Bombay ..	195·21	169·05	60·31	56·51	16·07	16·22	12·42	14·00	13·30	14·94	17·79	18·21	23·50	22·74	34·00	25·07	52·55	42·19	109·84	99·12
Central Provinces.*	309·14	345·31	49·38	40·30	20·34	16·63	14·70	13·07	22·12	19·19	21·54	16·89	28·42	21·97	39·73	29·78	61·10	48·67	105·42	84·66
Berar	318·94	280·80	101·36	88·54	20·69	18·15	11·48	12·02	12·59	14·32	15·83	17·80	21·33	20·84	33·32	21·84	57·79	44·82	113·26	103·42
Madras* ..	152·7	127·0	27·7	25·8	9·4	8·8	7·0	7·0	9·0	11·8	10·1	11·0	13·7	11·8	19·5	15·0	32·3	26·6	56·5	51·5
Coorg* ..	268·89	230·72	37·39	34·04	12·20	10·91	10·58	11·69	15·67	16·31	22·15	23·99	29·19	28·83	36·15	33·63	54·85	48·89	75·02	66·46

* Mean of nine years.

With regard to every province it will be observed that in infancy the male death-rate is the higher. In the age period 1-5 the male death-rate is the higher in all provinces except the Punjab. In the following age period Bombay is a second exception to the general rule. Between 10-15, females in the Punjab, Bombay, Berar and Coorg died at a greater rate than males; while in Madras males and females died at the same rate. In the age period 15–20, which represents early married life, females died at the higher rate in every province except in Bengal and the Central Provinces, and in Lower Burma, where marriage is later than in India. In the age period 20–30 the female death-rates were the higher everywhere, except in Bengal and the Central Provinces. Between the ages of 30 and 40 the female rates were the higher in Lower Burma and the Punjab alone, and after the age of 40 males died at the greater rate everywhere, except in the Punjab, where, after the age of 60, females died at the greater rate.

Mortality curves.—By using the figures in the table it is easy to make curves representing the average mortality among the two sexes in the different provinces during the ten years ending with 1900, and it is instructive to compare such curves with those representing English mortality.

Mortality in England and Wales, 1841–1850 *and* 1886–1895.—If curves exhibiting the mortality of males and females in England and Wales during the 10 years ending with 1850 are constructed, it will be found that the lines descend rapidly to the point represented by the age period 5–10, and from thence gradually to 10–15, whence there is a very gradual ascent to the age period 25–35, after which the ascent is more rapid, becoming steep after 45. Curves representing the mortality in England and Wales in the decennium ending 1895 retain the same general shape as those of the earlier decade, descending rapidly to the age period 5–10, gradually to a minimum in the age period 10–15, and then ascending slowly to 35, when the lines, especially that representing the mortality of males, ascend steeply. But in the curves of the later decennium the age period 5–10 is at a lower level, and the slope to 10–15 is more gradual ; the lower level is retained in the case of males to between 35 and 45, and in the case of females to the age of 55. There is another very important difference. Sixty years ago, female mortality was greater than male mortality between the ages of 10 and 20, and again between the ages of 25 and 35. In the 10 years ending with 1895, female mortality was greater than male mortality only between the ages of 10 and 15 ; the mortality of the sexes was equal between the ages of 15 and 20, after which females died at a much lower rate than males. The striking difference between the curves of the two decades is, then, the greatly lower level of the curves of the later period representing an enormous saving of life of children and adults up to early middle life, and especially of adolescent females and young married women.

Indian Provinces, 1891–1900.—If, now, the curves representing the average mortality in all Indian provinces during the 10 years ending with 1900 are examined, the contrast is very striking. There is the same rapid fall in early life to the age period 5–10, when there is generally another rapid fall to the age period 10–15, the lowest point in the male curve of every province, and in the female curve in every province except Assam and Coorg, in both of which the minimum occurs at the age period 5–10. From 15 the ascent begins, always less gradual than in the English curves, the lines representing male deaths rising steeply between 30 and 40, the lines representing female deaths between 40 and 50.

No Indian curve descends so low as even the 1841–50 English curves, and most Indian curves shew in a marked degree the interlacing of the lines representing male and female deaths which we have seen was a feature of the earlier English curves. In some provinces the charts are peculiar. The Madras curves are on a lower level and are more gradual than any of the others. The lines representing mortality in Coorg rise after 15 almost as rapidly as they descend to 15. The lines representing male deaths in Bengal and the Central Provinces are always higher than the lines representing female deaths, although at the ages between 15 and 20 the latter nearly approaches the former. On the other hand, the line representing female mortality in the Punjab is higher than the line representing male mortality, except in infancy and late middle age. The Bombay chart resembles that of the Punjab.

The Assam chart presents a remarkable feature. There is a very sharp rise about the age of 20 in the line representing males. A similar rise of the male curve appears in the charts of Bengal and the Central Provinces, but not so markedly as in the case of Assam. In most provinces there is a rise of the female curve at this age, and in all, except Bengal and the Central Provinces, the curve of female mortality rises above the curve of male mortality at the child-bearing period.

A study of the English charts shews the saving of life at the most enjoyable and useful ages which improvement in the environment has effected ; and a comparison of the Indian chart suggests that analogous improvements might effect enormous saving of life in India, particularly the lives of children and of young adults, and especially of women at the child-bearing age.

Mortality from chief diseases, 1891–1900.—Let us now analyse the figures registered regarding deaths caused by the principal diseases in the various provinces.

Cholera death-rates.—Cholera was the cause of deaths in every province in every year of the decennium, except in Ajmer-Merwara in 1894 and 1899, in Coorg in 1895, 1899 and 1900, and in the Punjab, the Central Provinces and Berar in 1898. The lowest death-rates recorded in the other provinces were ·91 in Bengal, ·05 in the United Provinces, and ·23 in Bombay, all in 1898 ; ·6 in Madras in 1895 and ·52 in Lower Burma in 1891. The lowest cholera death-rate recorded in Assam was 1·66, which, it may be noted, is much higher than the minimum recorded in any other province. Six

times in the ten years the highest provincial death-rate from cholera was recorded in Assam ; twice, in 1892 and 1900, in Ajmer-Merwara ; and once each in the United Provinces, in 1894, and the Central Provinces, 1896. The highest death-rates recorded during the ten years were 8·93 in Ajmer-Merwara and 8·71 in Bombay, both in 1900.

Cholera, sex mortality.—In Bengal, Madras and Lower Burma males suffered more than females in every year of the ten. In the remaining provinces the male rates were either higher than, or equal with the female rates, except in Assam where the female rates were the higher in five years, and the United Provinces where they were the higher in four years.

Cholera mortality, town and country.—Speaking generally, the rates were higher in the towns than in the country, but it was only in Bengal and Madras that this was invariably the case ; while in Bombay and the United Provinces the rates were higher in the country than in the towns, in eight years in the case of Bombay, and in six years in the case of the United Provinces.

Small-pox death-rates.—The small-pox death-rates varied greatly, between 7·05 per 1,000 recorded in Ajmer-Merwara in 1896, and ·01 recorded in Berar in 1891. From 1891 to 1893 the highest rates were recorded in Coorg. In five of the remaining seven years the highest rates were recorded in Ajmer-Merwara, Assam sharing the distinction in 1894, and the United Provinces and Lower Burma furnishing the highest rates in 1897 and 1898, respectively.

The lowest rates were registered once in Coorg, four times in Berar, and five times in the United Provinces. In 1895 the distinction was shared with the United Provinces by Coorg, and in 1897 the rate in Bombay was the same as that recorded in Berar.

Small-pox, sex mortality.—In most provinces, particularly Lower Burma, Bengal and the Central Provinces, males suffered more than females ; but in the Punjab the female death rates were higher than the male in six years, and equal with them in two years. In Ajmer-Merwara the female rates were higher than the male in seven years. In Berar and Madras, where the small-pox death rates were always low, the death-rates of the sexes were generally equal.

Small-pox mortality, town and country.—In Bombay and the Punjab the town populations suffered more than the country people, but in Lower Burma, Madras, Coorg and the United Provinces the rural populations suffered more than the urban.

Fever death-rates.—Under the heading fevers are included the deaths due to a large number of different diseases, and it is not possible in the present condition of registration to say what proportion in each province of the fever death-rate is due to malaria. Some of the provincial fever death-rates, however, maintain the same characters year after year. In Madras, where the death-rate from fever was lowest in every year of the decennium—except 1891, the rates varied from 9·0 to 7·3 per 1000, while in the little province of Coorg, embedded in Madras, they ranged from 41·50 to 15·61. In Lower Burma the rates were always low, fluctuating between 11·90 in 1898, and 7·76 in 1891.

In Berar the rates were generally low, but the range from the exceptional rate of 29·5 registered in 1900, to 11·5 in 1898, was considerable. In Assam the rates were uniform but on a somewhat higher level, varying between 28·74 in 1897 and 14·70 in 1900. In Bombay the lowest rate was 12·14, registered in 1899, and the highest rate, 28·87, was registered in the following year. In Bengal there was little variation in the rates, the maximum being 25·32 and the minimum 18·94 ; but in the Central Provinces the range was extreme, from 16·17 in 1899 to 40·98 in 1897. In the United Provinces the rates fluctuated between 18·84 and 31·88 ; and in the Punjab between 18·57 and 34·83. In Ajmer-Merwara the rates varied greatly, from 13·05 in 1891 to 81·56 in 1900.

Fever, sex mortality.—In every province, save the Punjab, Coorg, Ajmer-Merwara and Bombay, males invariably suffered more than females. In Bombay they suffered more in eight years, and in Ajmer-Merwara in six years. In Coorg, however, females are reported to have died at the greater rate in six of the ten years, and in the Punjab the female death-rate was invariably the higher.

Fever mortality, town and country.—In Bengal, the Punjab, the Central Provinces, and Coorg, the rural populations always suffered more than the urban populations, and they generally suffered more in the other provinces, except in the United Provinces, where in nine of the ten years the highest death-rates were registered among the towns' populations.

Dysentery and diarrhœa death-rates.—The recorded provincial death-rates from dysentery and diarrhœa display some remarkable peculiarities. In Bengal the rates were always low and fluctuated only slightly from ·91 to ·52 per 1,000, while in the neighbouring province of Assam the rates were uniformly high, varying between 4·61 and 2·74. In Madras the rates varied between 1·2 and ·7, whereas in Coorg the range was from 3·11 to ·64. In the United Provinces (1·41 to ·50), the Punjab (1·26 to ·59) and Lower Burma (1·95 to ·91), the variations were inconsiderable, but in Ajmer-Merwara the rates ranged from ·70 in 1896 to 15·90 in 1900. In 1900 enormous death-rates were registered also in Bombay, 11·59, and Berar, 22·4. In these provinces the rates in other years ranged in Bombay from 1·75 in 1893 to 4·57 in 1897, and in Berar, where the rates were always high, from 3·5 in 1898 to 10·3 in 1897. The Central Provinces also suffered excessively in 1900, when the rate was 5·16, and in 1897 when it was 8·53; the minimum for the 10 years in the Central Provinces, 1·23, being recorded in 1898.

Dysentery and diarrhœa sex mortality.—In every province, except Madras and Berar, in every year, males suffered more than females. In Madras the death-rates of the sexes were equal in 1895. In Berar the rates were equal in 1892 and 1899, and in 1891 the female rate was slightly the higher.

Dysentery and diarrhœa mortality, town and country.—In all provinces, except Bombay and Berar, the towns' populations suffered most. In Bombay in 1891 the rural death-rate was considerably the higher, and in Berar in every year, except in the famine years 1897 and 1900, the rural population suffered most.

All other causes.—It might be expected that the death-rates under the heading "all other causes" would be higher in the towns than in the rural areas, and, except in Berar in 1900, this was invaribly the case. The urban and rural maxima were registered in 1900 in every province except Assam, where the maxima were registered in 1897, and the United Provinces, where the maxima were registered in 1899. In Madras and Ajmer-Merwara although the highest urban rates were recorded in 1900, the highest rural rates were recorded in 1891 and 1894, respectively.

Before proceeding to the consideration of the statistics registered in the various provinces in 1901, the following figures relating to the populations claim attention.

Sex and age constitution of the populations.—The sex and age distribution of the people in the British provinces is shewn in the following table, in which is given the sex composition in 1891 and the sex and age and composition in 1901 of each thousand persons in each province.

Age and Sex Constitution of Provincial Populations.

Age group.	Census of	Bengal.		Assam.		United Provinces of Agra and Oudh		Punjab.		North West Frontier Province.		Central Provinces.		Berar.		Madras Presidency.		Coorg.		Bombay Presidency.		Ajmer-Merwara.		India excluding Burma†	
		Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.
Total ..	1891	498	502	515	485	518	482	539	461	540	460	* 500	* 500	515	485	495	505	554	446	518	482	532	468	509	491
Total ..	1901	501	499	513	487	516	484	538	462	545	455	492	508	506	494	493	507	555	445	516	484	526	474	508	492
Under one year..		14	15	18	18	16	15	17	16	18	17	11	11	9	10	14	15	15	76	11	11	7	6	15	14
1-5 years ..		52	56	55	58	48	48	52	48	58	58	51	54	41	45	52	54	38	39	50	51	29	26	50	53
5-10 „ ..		76	74	72	76	67	61	74	63	81	71	68	68	64	67	71	71	62	62	73	69	57	53	72	67
10-15 „ ..		62	50	58	47	65	52	67	50	63	45	65	57	67	59	64	57	66	58	67	54	72	59	64	53
15-20 „ ..		43	45	38	43	45	37	49	30	46	35	41	39	38	38	41	38	54	43	42	38	62	51	43	40
20-30 „ ..		83	89	88	95	83	86	87	80	91	77	85	94	87	94	72	86	124	94	90	87	111	100	84	87
30-40 „ ..		71	66	82	66	74	70	73	65	80	65	75	75	87	76	70	72	103	61	80	72	78	69	73	69
40-50 „ ..		49	46	49	39	55	52	53	46	50	42	50	52	58	51	52	50	55	36	52	49	61	56	51	48
50-60 „ ..		28	29	26	28	34	33	34	28	29	23	28	31	34	30	32	33	25	21	31	29	33	33	31	30
60 years and above.		23	29	20	20	24	29	33	27	29	22	17	26	22	24	26	30	13	15	20	24	16	20	24	28

* Fractions are omitted, but it should be noted that in the Central Provinces the male population is slightly the greater.
† The details of the figures for Burma are not available.

It will be observed that in 1891 in India there were 509 males to every 491 females, and that in 1901 the proportion of females had slightly increased, the figures being 508 males to 492 females. In 1891 there was an excess of males in every province except two, the excess being most marked in Coorg, the Punjab, and Ajmer-Merwara. In the Central Provinces the numbers of the sexes were nearly equal, and in Madras and Bengal there was a slight excess of females.

In 1901, the excess of females in Madras has increased, and there is now an excess of females in the Central Provinces; but in the vast population of Bengal the small excess of females has become a small excess of males, which is to be set off against the fact that in each of the remaining provinces, except Coorg, the excess of males has slightly diminished.

Birth-rates in 1901.—In 1901 the average birth-rate throughout the British provinces of India was 34·7 as compared with 36·6 in the preceding year, ranging from 41·35 per 1,000 of the population in the United Provinces to 16·10 in Ajmer-Merwara.

Birth-rates computed on the number of females in the populations.—It is sometimes urged in extenuation of the registration of a very low birth-rate that there is a deficiency of females in the population, so that it is of interest to compare the birth-rates obtained when the births recorded are computed upon the female populations between the ages of 15 and 40. This has been done in the table below.

Province.	Population of females, 15-40 years.	Total births, 1901 (males and females).	Birth-rate during 1901 (per 1,000 of females 15-40 years).	Arranged in Order.			
				Province.	Birth-rate (1901) per 1,000 of total population.	Province.	Birth-rate (1901) per 1,000 of females 15-40 years.
Bengal	14,948,435	2,870,806	192·0	United Provinces of Agra and Oudh.	41·35	United Provinces of Agra and Oudh.	214·3
Assam	1,081,618	179,289	163·8	Bengal	38·57	Bengal	192·0
United Provinces of Agra and Oudh.	9,201,734	1,972,131	214·3,	Punjab	35·4	Punjab	192·0
Punjab	3,711,390	712,553	192·0	Assam	33·98	Assam	165·8
North-West Frontier Province	364,401	60,413	165·8	Berar	30·8	North-West Frontier Province	165·8
Central Provinces	2,029,754	279,998	137·9	North-West Frontier Province	29·5	Berar	146·2
Berar	572,865	83,762	146·2	Central Provinces	28·83	Central Provinces	137·9
Madras Presidency	7,275,407	935 749	128·6	Bombay Presidency	25·19	Madras Presidency	128·6
Coorg	35,871	3,401	94·8	Madras „	25·1	Bombay „	1·8·9
Bombay Presidency	3,638,657	465.647	128·0	Coorg	18·83	Coorg	94·8
Ajmer-Merwara	104,873	7,679	73·2	Ajmer-Merwara	16·10	Ajmer-Merwara	73·2
Total	42,965,005	7,571,128		Total	16·10	Total	176·2

For facility of comparison the provinces have been arranged in two columns, in the first in order of descending birth-rates computed upon the numbers of the total populations, in the second in the order of descending birth-rates computed upon the numbers of females between the ages of 15 and 40.

It will be observed that both lists begin with the United Provinces, Bengal, the Punjab, and Assam, and both end with Coorg and Ajmer-Merwara. With rates computed on the total population, the North-West Frontier Province comes below Berar, and Madras below Bombay, but with rates computed on the number of females the positions are reversed.

Proportion of sexes at death, 1901.—In every thousand persons whose deaths were registered in India in 1901, there were 521 males and 479 females. In the United Provinces and Bombay the proportions of the sexes dying were the same as the average for all India. In Berar, the Punjab, and Madras, the excess of male deaths was less than the average. In the remaining provinces the excess of male deaths was greater than the average, considerably in Bengal, Assam, Ajmer-Merwara, and the Central Provinces, greatly in the North-West Frontier Province.

The following table gives the details, and also shows the age and sex composition of each thousand deaths in India and in each of the British provinces.

Age and Sex of each 1,000 *Persons who Died in each Province during* 1901.

Age group.	Bengal.		Assam.		United Provinces of Agra and Oudh.		Punjab.		North-West Frontier Province.		Central Provinces.		Berar.		Madras Presidency.		Coorg.		Bombay Presidency.		Ajmer-Merwara.		India (excluding Burma).	
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.
Total	526	474	527	473	521	479	512	488	531	469	528	472	511	489	512	488	560	440	521	479	527	473	521	479
Under one year	121	104	124	115	168	150	126	120	148	113	152	130	117	102	105	91	73	74	70	62	63	56	126	111
1-5 years	75	71	70	72	85	87	99	96	98	93	73	65	102	100	67	66	43	36	72	71	67	53	79	74
5-10 „	43	36	40	33	24	19	31	30	32	29	32	27	32	32	32	30	23	22	37	37	39	33	35	30
10-15 „	28	21	28	21	16	12	17	17	16	15	18	15	16	16	21	19	19	15	29	28	23	23	23	19
15-20 „	24	25	25	32	15	18	14	14	14	14	17	15	10	12	19	22	29	24	21	21	29	30	19	21
20-30 „	50	51	55	68	38	43	30	33	37	42	37	36	29	38	41	48	113	87	57	53	66	59	44	47
30-40 „	49	41	60	46	39	34	33	34	42	45	45	36	40	37	47	42	99	65	63	51	62	53	46	40
40-50 „	42	33	45	27	42	35	36	31	40	37	47	33	43	32	49	37	73	44	56	41	70	56	44	35
50-60 „	35	33	36	25	42	35	39	31	37	29	41	35	47	36	51	44	51	45	49	38	63	58	41	35
60 years and above ..	58	61	45	34	52	46	87	79	66	52	66	80	75	70	81	89	36	30	67	77	44	49	64	65

In every province more males died than females, and in every province, except the Punjab and the North-West Frontier Province, the male death-rate was the higher. Under ordinary circumstances, males die at a greater rate than females at all ages except those at which reproduction takes place.

Fallacy of crude death-rates.—It is evident, then, that other things being equal, the higher the proportion of males in a population the higher the death-rate will be. But children, particularly infants, and aged persons die at a greater rate than persons in the prime of life; so that the more infants and old people in a population the higher the death-rate will be, apart altogether from conditions specially affecting health; although, of course, the more unfavourable the conditions, the more will children and old people suffer. A glance at the table on page 84 will show how different are the age and sex constitutions of the different Indian Provinces. As instances, there are 18 male infants in the North-West Frontier Province for every 7 in Ajmer-Merwara, while there are 33 old men in the Punjab for every 13 in Coorg. As in India generally, in 1901 the death-rate of male infants was 253·0 and of old men 77·4 among every thousand, it is obvious that death-rates computed without reference to the age constitution of the populations fail as an index of salubrity or the reverse, and that some method of correction is necessary. Where there is no difficulty in estimating the population from year to year and registration is accurate, such a correction is easily made; but in India where the gradual increase of the populations is checked by famine and rendered irregular by the occurrence of great epidemics, the difficulty is very great, while the value of the correction is reduced by the fact that deficiencies in registration may and do cause a greater difference in the actual total than the correction.

Attempt to correct death-rates.—In the following table an attempt is made to correct the provincial death-rates;—

Province.	Standard death-rate.	Factor for correction for sex and age distribution.	Recorded death-rate for 1901.	Corrected death-rate for 1901.	Comparative mortality figure, 1901.
(1)	(2)	(3)	(4)	(5)	(6)
India	29·6	1·00	29·6	29·6	1,000
Bengal	29·5	1·00	31·04	31·04	1,049
Assam	30·5	·97	27·85	27·01	912
United Provinces of Agra and Oudh ...	30·0	·99	30·30	30·00	1,014
Punjab	30·7	·96	36·13	34·68	1,172
North-West Frontier Province	31·2	·95	19·16	18·20	615
Central Provinces	27·4	1·08	23·46	25·34	856
Berar	26·6	1·11	27·6	30·64	1,035
Madras Presidency	30·0	·99	21·3	21·09	712
Coorg	27·6	1·07	36·49	39·04	1,319
Bombay Presidency	27·4	1·08	37·12	40·09	1,354
Ajmer-Merwara	23·8	1·24	33·13	41·08	1,388

Method used for correction.—Column 2.—The standard death-rate is obtained in the following way.* The population of all India as determined by the census of 1901 is divided into two groups, males and females. Each group is then subdivided by age-periods into ten sub-groups.† The numbers of deaths registered in 1901‡ in each sub-group are then used to calculate the death-rate per 1,000 of that sub-group. In the case of each province the popoulation is divided by sex and age periods into similar sub groups. Against each sub-group the death-rate recorded in the corresponding sub-group in the population of all India is placed, and the number of deaths corresponding to that death-rate is assumed to have taken place in the sub-group. From the aggregate number of assumed deaths in the sub-groups a death-rate per 1,000 of the actual population of the province is calculated.

Thus the standard death-rate for all India is the recorded death-rate, while the standard death-rate for a province is that which would be registered if the mortality in the province among the two sexes at different ages was exactly the same as in all India.

Column 3.—The factor for correction is obtained by dividing the standard Indian death-rate by the provincial standard death-rate.

Column 4.—Contains the death rate recorded in 1901.

Column 5.—The corrected death-rate is obtained by multiplying the recorded death-rate by the factor for correction.

Column 6.—The comparative mortality figures correspond to the corrected death-rates. The death-rate for India being taken as 1,000, the provincial death-rates are brought to the proportional whole number.

* The methods will be found fully described in Dr. Newsholme's "Elements of Vital Statistics," 3rd Edition, page 109. *Cf.* Dr. Ogle's letter to the Registrar General in the supplement to his forty-fifth Annual Report.

† Age periods 0-1, 1-5, 5-10, 10-15, 15-20, 20-30, 30-40, 40-50, 50-60, 60 and upwards.

‡ A ten years' average is out of the question.

If the provinces are arranged in two columns according to the recorded death-rates and the corrected death-rates, it will be noticed that, except in the case of Ajmer-Merwara, no important change results in the relative position of the Provinces. The comparative mortality figures are, however, interesting.

The following statement furnishes a brief epitome of the birth and death statistics recorded in the different provinces in 1900 and 1901 :—

Birth and Death Statistics.

Province.		Births.			Number of deaths.			Ratio of deaths per 1,000 of population.			Mean death-rate during previous 5 years.			Number of deaths of males to every 100 deaths of females.
		Total number.	Ratio per 1,000 of population.	Mean ratio per 1,000 of population during previous five years.	In Municipalities and towns.	In Districts, excluding towns.	Total.	In Municipalities and towns.	In Districts, excluding towns.	Total.	In Municipalities and towns.	In Districts, excluding towns.	Total.	
Bengal	1900	2,749,582	38·68	37·66	151,015	2,452,721	2,603,736	43·46	36·28	36·63	33·00	31·17	31·26	113*
	1901	2,870,806	38·57	36·74	136,360	2,174,164	2,310,424	37·12	30·72	31·04	32·99	30·73	30·85	110*
Assam	1900	184,427	34·96	30·63	3,961	157,670	161,631	38·62	30·48	30·64	45·00	35·25	35·44	112·94
	1901	179,289	33·98	31·77	3,206	143,733	146,939	29·74	27·81	27·85	42·56	35·04	35·19	111·62
United Provinces of Agra and Oudh.	1900	1,892,169	40·34	37·37	136,339	1,323,800	1,460,139	42·13	30·31	31·13	39·16	32·22	32·70	111·21
	1901	1,972,131	41·35	38·45	144,979	1,300,056	1,445,035	42·87	29·34	30·30	40·60	32·52	33·09	108·79
Punjab	1900	843,970	41·1	43·8	109,674	870,537	980,211	54·55	46·92	47·69	33·65	30·14	30·50	105·2
	1901	712,533	35·4	41·1	75,188	651,423	726,611	37·71	35·96	36·13	35·65	32·04	32·40	105·2
North-West Frontier Province.†	1900	—	—	—	—	—	—	—	—	—	—	—	—	—
	1901	60,413	29·5	37·1	3,768	35,440	39,208	18·28	19·26	19·16	33·73	30·82	30·40	113·3
Central Provinces.*	1900	303,121	31·90	33·98	48,402	490,832	539,234	59·28	56·51	56·75	46·18	41·12	41·29	119·43
	1901	279,998	28·83	†	22,290	205,563	227,853	28·49	23·02	23·46	†	†	†	111·92
Berar	1900	89,302	31·3	39·4	31,041	204,981	236,022	87·2	82·1	82·7	43·1	41·8	41·9	115·3
	1901	83,762	30·8	38·2	12,329	62,751	75,080	29·6	27·2	27·6	51·1	48·1	48·5	104·4
Madras Presidency.	1900	1,049,199	31·8	29·3	83,561	687,298	770,859	32·6	22·6	23·4	29·4	20·7	21·3	105·5
	1901	935,749	25·1	29·8	94,710	701,430	796,140	32·7	20·4	21·3	30·5	21·4	22·1	105·1
Coorg	1900	4,542	26·25	23·00	814	5,488	6,302	52·48	34·83	36·42	41·38	32·22	33·04	130·67
	1901	3,401	18·83	22·00	811	5,779	6,590	53·18	34·95	38·49	45·67	31·85	33·02	127·24
Bombay Presidency.	1900	505,662	26·87	34·68	235,817	1,082,966	1,318,783	102·33	65·57	70·07	47·42	30·99	33·01	116·0
	1901	465,647	25·19	32·89	139,794	546,340	686,134	57·85	34·01	37·12	61·65	38·45	41·30	108·1
Lower Burma ..	1900	171,183	38·37	32·86	19,487	103,227	122,714	32·70	26·71	27·51	31·10	24·25	25·14	128*
	1901	177,865	32·07	34·72	19,919	100,646	120,565	29·99	20·62	21·74	32·19	25·26	26·17	129*
Upper Burma‡ ..	1900	11,489‡	36·87‡	‡	10,231	43,265	53,496	32·83	20·19	21·80	—	—	—	99*
	1901	11,334	37·66	—	10,010	—	10,010	33·27	—	33·27	—	—	—	111*
Ajmer-Merwara	1900	7,958	14·67	32·57	19,555	45,512	65,067	137·51	108·83	119·97	37·29	24·00	27·04	123·84
	1901	7,679	16·10	32·36	5,064	10,734	15,798	39·06	30·91	33·13	59·55	49·01	51·91	111·20

* Excluding Zamindaries. † Not available ‡ Statistics for 13 towns.

Bengal.—The rainfall in Bengal in 1901 was scanty and unevenly distributed, the south-west monsoon began late and ceased early, and the October rainfall was in defect everywhere except in Eastern Bengal. Unfavourable meteorological conditions affected the outturn of food grains which was below the average in many districts. The number of births recorded during the year was 2,870,806, or 121,224 more than in 1900. The birth-rate was 38·57, or 1·63 per 1,000 higher than that of the preceding year calculated upon the same population, while it was 1·83 per 1,000 higher than the quinquennial average computed on the census figure of 1891. It would appear then that registration is improving, but that much remains to be done is evident from the great divergence in the birth-rates of the different districts, from 19 of which, headed by Muzaffarpur (44·69), Dinajpur (44·41), and Patna (44·06), rates in excess of 40 per 1,000 were returned, while in four—Puri (29·57), Hooghly (27·99), 24-Parganas (27·70), and Calcutta (10·76)—the rates were below 30 per 1,000. In only ten towns were birth-rates recorded in excess of 40 per 1,000, and, generally speaking, the birth-rates in towns were much lower than the birth-rates in the adjoining country. The causes of this are explained to be the large floating population and the deficiency of females in the towns, and the custom of sending townswomen to be delivered in the country. It might be added that registration is less defective in the country than in the towns. The average percentage number of male to female births was 105, but the variations, though not extreme, were considerable, from 111 in the 24-Parganas and 110 in Calcutta and Hooghly where the lowest provincial birth-rates were registered, and 110 in Purnea, to 101 in Palamau.

The total number of deaths recorded was 2,310,424, or 293,312 fewer than in 1900. The death-rate was 31·04 per 1,000 of the population, and ·19 per 1,000 higher than the quinquennial average calculated upon the smaller population of the 1891 census. By far the highest district death-rate was 56·79, registered in Patna, only two others were over 40 per 1,000, Gaya (45·68), and Puri (41·32). The three lowest death-rates were 20·21, 20·70, and 20·88, in the Sonthal Parganas, Ranchi, and Singhbum, respectively. The average urban death-rate was 37·12, or 6·40 per 1,000 more than in the country, the excess being mainly due to diseases registered under the heading "other causes." Deaths ascribed to fevers were, however, far more numerous in the country than in the towns, while to dysentery and diarrhœa were ascribed a far larger number of deaths in the towns than in the country.

These results are in accordance with what we might expect. Where there is no scarcity, dysentery and diarrhœa are far more dangerous to children in crowded areas than in the open country, while precision of diagnosis tends to raise the proportion of deaths registered under "other causes."

The variation in the actual rates recorded in the different towns was enormous, due in cases, where the rates were excessive, to the occurrence of epidemic disease, and when the rates were very low to bad registration and to deficient numbers of females.

The mortality among infants was 189·56 among males and 171·96 among females, per 1,000 born. Children between one year and five years of age died at the rates of 44·87 and 39·15 per 1,000 boys and girls living at that age.

At all ages the male death rates were higher than the female, the averages being 32·64 per 1,000 for males and 29·44 for females.

Hindus died at the rate of 32·12 per 1,000 and Muhammadans at the rate of 30·06; other classes and Budhists at the rates of 21·73 and 21·58; and Christians at the rate of 16·69.

Port of Calcutta.—The number of European seamen estimated to have arrived in the port of Calcutta was 19,630, or 1,813 less than in 1900, but the daily average number in the port was 1,150 against 989. Only 19 deaths occurred, yielding a death rate of 16·52 per 1,000 as compared with 51 deaths and a death rate of 51·56 in the previous year. The average daily native population of the port was 25,630. Only 137 deaths were reported among them, equal to a death rate of 5·34 per 1,000 against 9·40 per 1,000 in 1900.

Assam.—In Assam registration is carried out in the Surma and Brahmaputra valleys and in parts of certain hill districts, viz., the Khasi and Jaintia Hills, the Garo Hills and the Naga Hills, but the general provincial statistics refer to the Surma and Brahmaputra valleys only. In 1901, the number of births recorded was 179,289 as compared with 184,427 in the preceding year. The birth rate in 1901 was 33·98. The populations of the two valleys are approximately equal in number, but registration is apparently on the

whole better in the Surma than in the Brahmaputra valley, for in only one district of the latter, Goalpara, are the figures obtained in accordance with the probable facts. The highest district birth rate was 44·25 per 1,000 in Goalpara, followed by 36·49 and 35·38 in Sylhet and Cachar, respectively. In three districts, Nowgong (29·84), Sibsagar (26·34), and Lakhimpur (26·28) the rates were lower than 30 per 1,000. In the towns the average birth rate was 29·82 per 1,000, ranging from 47·71 in Barpeta and 36·57 in Nowgong, to 20·20 in Silchar and 12·88 in Tezpur. It is explained that a considerable number of births registered as taking place in Barpeta occur in extra-municipal areas, the population of which is not reckoned in that of the town ; while of Tezpur it is said that registration is more defective than in any other town. The average percentage of male to female births was 107·97, varying between 104·45 in Goalpara and 111·88 in Sibsagar.

The number of deaths registered was 146,939, or 14,692 fewer than in 1900, yielding a death rate of 27·85 per 1,000. Among the districts the highest death rates were recorded in Darrang (35·19), Goalpara (34·09) and Cachar (29·96), and the lowest in Lakhimpur (24·11), Kamrup (23·04) and Sibsagar (21·71). The urban death rate was 29·74, or 1·93 higher than the rural, and ranged from 54·26 in Golaghat and 42·72 in North Lakhimpur, in both of which fevers and bowel complaints caused excessive death rates, to 14·11 in Maulvi Bazar. In the province generally, the lowest mortality occurred in February, and the highest in May. In the Surma Valley the minimum mortality was recorded in October and the maximum in December, while in the Brahmaputra Valley the fewest deaths were recorded in February and the most in July.

The recorded mortality among male infants was 195·4 and among female infants 195·8 per 1,000 born, respectively. In the age periods 15–20 and 20–30, the female mortality was higher than the male, the averages for all age periods being 28·51 among males and 27·16 among females.

Immigration.—There has been a great decline in the numbers of immigrants during the last five years. In 1897 the total number was 95,931, in 1898 the number fell to 49,169, and in 1899 to 31,908. In 1900 there was famine in the recruiting districts and the number of immigrants rose to 62,733, but in 1901 it fell to 26,233. The cause of the falling-off in the number of immigrants is ascribed to the depressed state of the tea industry and to the more stringent provisions of the new Labour Act. There has been a very satisfactory decrease in the mortality among the coolies in transit. In the Brahmaputra Valley the number of deaths during transit, including deaths at the depôts in 1901, was 69, including 48 from cholera, against 594, including 528 from cholera in 1900. The Assam-Bengal Railway is now being largely used for the conveyance of coolies in the Surma Valley. There were only two deaths in this area, both at river depôts.

United Provinces of Agra and Oudh.—The number of births recorded in the United Provinces was 1,972,131, or about 80,000 more than in 1900, yielding a birth rate of 41·35 per 1,000. In 11 of the districts, headed by Hardoi (51·28), Moradabad (50·13) and Budaun (49·93), the birth rates were more than 45 per 1,000, and in only two districts, Dehra Dun (27·81) and Azamgarh (28·94), were they lower than 30 per 1,000. The average birth rate in the towns was 40·28, the highest rates being 57·90, 55·54 and 54·51 in Pihani, Rae Bareli and Bilsi, respectively. In Naini Tal (18·08) and Mussoorie (16·67) the birth rates were below 20 per 1,000. The percentage of male and female births ranged from 113·61 in Muzaffarnagar, to 101·92 in Garhwal, the provincial average being 107·73.

The death rate was 30·30 per 1,000 of the population, the number of deaths recorded having been 1,445,035, or about 15,000 fewer than in 1900. The highest district death-rates were recorded in Benares (40·35) where plague occurred, Farrukhabad (39·84), where the "fever" death rate was very high and cholera was present, and Hardoi (38·69), where 5·33 per 1,000 of the population died of cholera. In 21 districts, including all those in the Fyzabad and Gorakhpur Divisions, the death rates were below 30 per 1,000, the lowest being 21·10, 20·89 and 19·69 recorded in Azamgarh, Almora and Gorakhpur respectively. In the town of Sahatwar in Ballia the death-rate of 110·90 was registered, including rates of 63·52 under the heading "fevers," and 28·93 from cholera. In Brindaban, where cholera was severe (6·82), and fevers extraordinarily so (66·29), the death-rate was 76·11 ; and in Benares, where plague was prevalent, it was 74·66. In 12 others of the larger towns the rates were over 50, and in only 15 were they lower than 30 per 1,000, the average urban death-rate being 42·87, as compared with 29·34 in the

rural circles. The monthly death-rate, which was 1·99 in January, fell in February to 1 69, and then rose fairly steadily until October, when the maximum, 3·62 was reached, after which the death-rate fell to 3·30 in December.

The death-rates of Christians and 'Other Classes' were computed at 8·82 and 17·35 per 1,000, respectively, but the figures in certain of the districts are obviously not correct. Muhammadans died at the rate of 28·81, and Hindus, who constitute more than five-sixths of the population, at the rate of 30·65.

The death-rate of male infants was 237·33 and of female infants 227·83 per 1000 born, respectively. Boys and girls between the ages of one year and five years died at the rates of 54·12 and 54·50 per thousand living as determined by the recent census. At all other age-periods, save 15-20 and 20-30, the male were higher than the female death-rates, the averages being 30·59 for males and 29·99 for females.

Punjab.—The exceptionally unhealthy autumn of 1900 resulted in a considerable decline in the birth-rate in the Punjab and only 712,553 births were registered, equal to a birth-rate of 35·4 per thousand of the population. In only three districts Sialkot (44·1), Gurgaon (40·6) and Gujranwala (40·1) were the rates over 40 per 1000, while in four, Umballa (29·1), Montgomery (28·5), Ferozepore (28·2) and Simla (15·8) they were under 30. In the district of Jhang alone, was the birth-rate in excess of the quinquennial mean, and in twelve districts the births were exceeded in number by the deaths. The provincial percentage of male to female births was 110·1, the percentage ranging from 119·9 in Dera Ghazi Khan to 106 in Ludhiana.

The recorded deaths numbered 726,611 against 980,211 in 1900, and the death-rate was 36·1 per thousand. In several of the districts, notably Ludhiana (52·2), Karnal (51·5) and Ferozepore (48·8) excessively high rates were registered. Ludhiana and Ferozepore were among the ten districts in which plague occurred, but in nether of them was the death-rate attributed to plague high ; in both districts, however, as well as in Karnal the fever and "all other causes" death-rates were high, which in the cases of Ludhiana and Ferozepore is suggestive of the faulty registration of plague, or of the occurrence of some other very fatal epidemic disease. The urban death-rate was 37·71. or 1·75 per 1000 higher than the rural death-rate. Enormous death-rates were registered in many of the towns, Rahon, where to plague and "other causes" death-rates of 8·55 and 49·48 respectively, were ascribed, heading the list with a death-rate of 90·97 per thousand, Zaffarwal, a small town in the Sialkot district, followed with 89·09 per thousand, including 36·47 from plague. The next highest death-rate was 88·38 recorded in Kila Sobha Sing, also a small town in Sialkot where the significant death-rate of 60·22 was registered as due to fevers, and only 8·39 as due to plague.

The death-rates among the various sects shewed considerable variation, 15·57 among Christians and 44·62 among 'Other Classes' being the extremes; Hindus and Muhammadans died at the rates of 39·14 and 33·58, respectively.

The spring and summer were the healthiest seasons ; the maximum mortality was reached in November 5·10 and December 5·08.

The death-rates among infants were 296 and 260 per 1000 males and females born, respectively. At all age-periods except 40—50 and 50—60, the female death-rates were the higher, the averages being 34·5 for male and 38·1 for females. In every district, except Jhelum, the female death-rate in 1901 was higher than the male, but the differences were not great in the districts of the Rawal Pindi Division, where, as also in Mianwali, Gurgaon and Rohtak, the quinquennial mean death-rates of males were either slightly higher than, or about the same as, the death-rates of females.

North-West Frontier Province.—In the North-West Frontier Province, which comprises the districts of Hazara, Peshawar, Kohat, Bunnu and Dera Ismail Khan, the number of births recorded in 1901 was 60,413 as compared with 62,084 in the preceding year. The birth-rate was 29·5, ranging in the districts from 33·6 in Kohat to 24·7 in Peshawar. The registered percentage of male to female births was 123·2, the district figures varying between the extraordinary one of 138·7 in Peshawar, and the high one of 111·1 in Hazara.

Deaths numbered 39,208 against 52,103 in 1900. The provincial death-rate was 19·2, varying between 25·6 in Dera Ismail Khan and 16·6 in Hazara. The urban death-rate was 18·28, or ·98 per thousand lower than in the rural areas, and ranged from 30·63 in Nawashahr to 13·11 in Kohat and 4·17 in Abbottabad. The Hindu death-rate was 17·44 as compared with 19·53 among Muhammadans.

The lowest death-rates 1.34 occurred in the months of April and September, and the highest 2·06 and 2·05 in November and December, respectively. The death-rate among male infants was 174·48 and among female infants 163·00, per 1,000 born, respectively. At all age-periods, except 1·5 and 50-60, the female death-rates were the higher.

Central Provinces.—Only 279,998, births were recorded in the Central Provinces, including the zamindaries, against 313,116 in 1900, and the birth-rate in 1901 was 28·83, a lower rate than any recorded during the last 20 years, except in 1897, when the rate was 26·83 per thousand. In only four districts, Nimar (37·22), Burhanpur (35·45), Chhindwara (35·35) and Mandla (35·05), were the birth-rates over 35, and in three Raipur (24·64), Bhandara (21·35) and Chanda (20·69), they were under 25 per 1000. In five districts the rates were higher than the quinquennial means, but in only two, Bhandara and Chanda, did the number of deaths exceed the number of births. The average birth-rate in the towns, 29·21, was slightly in excess of the average in rural areas, 28·80. The percentage of male to female births throughout the province was 105·94, ranging in the districts from 113·41 in Burhanpur, to 101·94 in Damoh.

The number of deaths registered was 227,853, and the death-rate was 23·46, as compared with 57·82 in 1900, and the quinquennial average of 45·56 excluding zamindaris, computed on the larger population of the 1891 census. In only eight of the twenty districts were the rates over 25 per 1,000, the highest being 29·44 in Jubbulpore, 29·34 in Wardha and 29·11 in Burhanpur; while in four districts rates below 20 per 1,000 were recorded—Bilaspur 19·85, Murwara 19·81, Seoni 19·33 and Mandla 18·77. The urban death-rate was 28·49 against 23·02 in rural areas, the excess being due to smallpox, bowel complaints and diseases registered under the heading "all other causes." Among the towns, Burhanpur (37·04) Arvi (35·78) in the Wardha district, and Sehora (35·39), in Jubbulpore, had the highest death-rates, and low rates were registered in Pauni (16·66), Saugor Cantonment (16·30), Garhakota (15·16) and Bilaspur (14·05).

Hindus, who constitute the vast majority of the population, died at the rate of 20·67 per 1,000, Muhammadans at the rate of 26·66 and "Other Classes" at the 40·12.

The death-rate was 2·35 in January, and fell fairly steadily to a minimum of 1·45 in July, a gradual rise in August and September was followed by a sudden rise to the maximum of the year, 2·50, in October, followed by rates of 2·39 in November and 2·47 in December.

The death-rate among male infants was 246·41 for every 1,000 born, and among females 224·63. In every age-period the male death-rate was higher than the female, the average being 25·21 among males and 21·77 among females.

Berar.—The number of births recorded in Berar in 1901 was only 83,762, and the birth-rate was 30·8 per 1,000, as compared with 31·3 in the previous year, and a quinquennial mean of 38·2, calculated upon the *higher* census population of 1891. The falling-off in the number of births, as compared with the numbers recorded in recent years, which is attributable to the famine and few marriages in 1901, is common to all the districts; the highest rates being 34·3 in Wun and the lowest 28·9 in Ellichpur. The percentage of male to female births in the province generally was 104·6, ranging from 107 in Ellichpur to 101·6 in Basim.

But the year was a very healthy one, and the total number of deaths registered was only 75,080, equal to a death-rate of 27·6 per 1,000, which is almost exactly a third of the rate in 1900, and nearly 21 per 1,000 less than the five years' mean. In the districts, the rates varied between 30·2 in Akola and 25·2 in Wun. In the towns the variation was greater, between 38·3 in Anjangaon and 18·3 in Ellichpur, the average being 29·6 against 27·2 in rural circles.

The vast majority of the population are Hindus, and among them the death-rate was 27·7, followed by 27·4 among the small population of Christians. Muhammadans died at the rate of 25·6, and "Other Classes" at the rate of 29·3.

The monthly death-rate, which was 2·7 per 1,000 in January, fell steadily with the exception of a slight rise in April, to a minimum of 1·3 in June, after which the rise was fairly rapid to a maximum of 3·4 in October, followed by a gradual fall to 2·8 in December.

The death-rate of male infants was 205·30, and of females 187·92, per 1,000 born, respectively, while boys and girls over one and under five years of age died at the rates of

68·0 and 61·4 per 1,000 living. At the age-periods between 10 and 40 years of age, the female death-rates were the higher, the average for males at all ages being 27·9 and for females 27·4 per 1,000.

Madras.—The total number of births recorded in Madras was 935,749 or 113,450 fewer than in 1900, the deficiency being attributed by the Sanitary Commissioner of the Presidency to the depressing influence upon fecundity of the high prices of food grains in 1900. The birth-rate was 25·1 per 1,000, considerably less than the birth-rate of the preceding year, and less than the five years' average calculated upon the same population. The highest birth-rate was 37·1, registered in the urban district of Madras, and this was followed by rates of 31·8 and 30·5 in Tinnevelly and Tanjore, respectively. In Ganjam (20·5), North Arcot (19·1) and Madura (16·1) the lowest rates were recorded. The average urban birth-rate was 30·7 per 1,000 as compared with 24·6 in the rural circles. The percentage of male to female births averaged 104·2, and ranged from 108·1 in Ganjam, where registration is very defective, and 106·2 in Godavari and North Arcot, to 99·8 in Nellore, a district in which the population is nearly a million and a half, and where the percentage in 1900 was 102·2.

The recorded deaths in 1901 numbered 796,140, or about 25,000 more than in the preceding year, and the death-rate was 21·3 per 1,000. The variation in the districts was extreme, from 55·5 in Madras, where the highest rates under the headings fevers, dysentery and diarrhœa and 'other causes' were registered, to 10·9 in Madura. In Chingleput (30·1), South Canara (26·0) and Tanjore (24·7) the rates were comparatively high, and in Ganjam (14·8) and Vizagapatam (14·6) they were very low. Plague occurred in fifteen of the twenty-two districts, but the death-rates recorded as due to it were low, except in the cases of Bellary (1·1) and Salem (·7). The urban death-rate was 32·7 or 12·3 per 1,000 in excess of the rural rate. The town of Vaniyambadi in the Salem district suffered very severely from both plague (64·1) and cholera (27·7), the total death-rate being 141·3, including 14·6 per 1,000 registered under 'other causes.' In Bellary the death-rate was 48·1 per 1,000, including 12·1 from plague and 26·6 from 'other causes.'

The death-rate among Christians was 17·0, among Hindus 21·6 and among Muhammadans 22·5. The death-rate among 'Other Classes' was reported to be 4·4 per 1,000 and furnishes an example of defective registration; in Ganjam the population of 'Other Classes' is 277,377 and the number of deaths reported among them was 53; in Cuddapah the 'Other Classes' total 353 and the deaths recorded 124.

The monthly death-rates were lowest in March, April and May, highest in October, November and December.

The death-rates among infants were 174·54 and 159·39 per 1,000 males and females born, respectively. At all age-periods except 15–20, the male death-rates were the higher, the averages being 22·2 for males and 20·5 for females.

Coorg.—The number of births in the small province of Coorg was 3,401, as compared with 4,542 in 1900, and the average birth-rate, which ranged in the districts from 28·34 in Padinalknad Taluk to 14·50 in Kiggatnad Taluk, was 18·83. The rates are said to be necessarily low owing to the large number of temporary immigrants included in the census population. The percentage of male to female births was 98·31, varying between 103·80 in Yedenalknad Taluk and 92·18 in Padinalknad Taluk.

The number of deaths recorded was 6,590, and the death-rate was 36,49 varying from 43·89 per 1,000 in Padinalknad Taluk and 29·35 in Kiggatnad. The death-rate in the towns was 53·18, ranging from 83·82 in Verajendrapet, where dysentery and diarrhœa caused a death-rate of 20·79, to 23·13 in the village of Fraserpet. The greatest mortality occurred in June, May and July, and the least in October and November. Muhammadans died at the rate of 39·62 per 1,000 and Hindus at the rate of 36·08. The death-rates among male and female infants were, respectively, 287·07 and 283·38 per 1,000 born. At all age-periods, except 15–20 and 30–40, the male death-rates were the higher, the averages being 36·80 among males and 36·09 among females.

Bombay.—The depressing effect of conditions of famine on fecundity is strikingly shown in the Bombay registration returns of 1901. The number of births recorded was only 465,647, a smaller number than any registered since 1882, and no less than 177,067 fewer than the mean number recorded in the ten years ending with 1900. The birth-rate was 25·19 per 1,000. In seventeen of the twenty-five districts the birth-rates were lower than the death-rates, the excess of the latter over the former reaching the excessive

proportions of 60·30 per 1,000 in the city of Bombay, and 48·56 per 1,000 in Belgaum The highest district birth-rates are 33·43 in Khandesh, 32·41 in Broach and 31·89 in Ahmednagar. In ten districts the birth-rate was below 25 per 1,000, the lowest being 17·48 in Bombay, 15·06 in Hyderabad and 8·36 in Thar and Parkar, in which district it is stated that the extraordinarily low rate was due to the exodus of the people on account of the scarcity. The urban birth-rate, 22·72, was lower than the rural rate by 2·85, the deficiency being in part due to families leaving the towns on account of plague, and in part to the greater deficiency of registration in the towns. The effect of famine on the birth-rate, which began to show itself in April 1900, reached its climax in March 1901, when only 24,840 births were registered, after which the numbers gradually rose to the maximum of 54,554 in October; and in December the number of births recorded was rather higher than the average number recorded in that month.

Compared with the appalling mortality of 1900, when the recorded deaths numbered 1,318,783, the total of 1901 looks small, but the number of deaths recorded, 686,134, is greater than the number recorded in any other year. The death-rate of the Presidency was 37·12, varying in the districts from 77·78 in the city of Bombay, to 13·21 in Upper Sind Frontier. The rates were over 50 per 1,000 in four districts besides the city of Bombay, namely, Belgaum, 71·91, Dharwar, 71·26, Ahmedabad, 52·68 and Broach, 50·38. In Bombay, Belgaum and Dharwar the excessive rates resulted from plague, but in Broach the death-rate, including only 6·50 per 1,000 ascribed to plague, was due to high-rates under 'fevers' and 'other causes'; while in Ahmedabad it was due to the excessive rate of 43·69 under 'fevers.' Low rates were recorded in Ratnagiri (21·10) and in all the Sind districts, except Karachi. The death-rates in the towns averaged 57·85 against 34·01 in the rural areas. The plague death-rate in the towns was 15·15 against 5·7 in the districts; the fever rates in town and country were 14·46 and 16·0; the dysentery and diarrhœa rates, 4·35 and 3·09, and the 'all other causes' rates 22·33 and 7·83. Plague deaths occurred in thirty-six of the sixty-three towns, the death-rates from this cause being in many instances enormous, *e.g.*, in Dharwar the plague death-rate was 58·67 and the total death-rate 105·58, in Hubli, also in the Dharwar district, the plague death-rate was 51·12 and the total death-rate 83·99, in Gadag-Bettigeri the plague death-rate was 47·96 and the total death-rate 75·33 per 1,000. In the small town of Gogha, in the Ahmedabad district, the death-rate was 177·37 per 1,000, including 27·72 from plague, and 103·38 ascribed to fevers.

Parsis died at the rate of 27·14 per 1,000, Muhammadans at the rate of 28·10 and Hindus at the rate of 39·69.

The greatest mortality occurred in the months of December, November and October, and the least in May, June and July.

The registered mortality among male infants was 198·13, and among female infants 189·28 per 1,000 recorded births, respectively. In the age-periods, 5–10 and 15–20, the female death-rates were the higher, the average death-rates of the sexes being 37·52 among males and 36·70 among females.

Burma.—The number of births registered in Lower Burma was 177,865, or 6,682 more than in 1900, and the birth-rate was 32·07. The rates in the districts varied greatly, from 40·68 per 1,000 in Henzada, 38·72 in Tharrawaddy, and 37·80 in Sandoway, to 27·83 in Akyab, 25·94 in Thaton, and 25·33 in Toungoo. The lowest rate recorded was 12·70 in the urban district of Rangoon, where the proportion of males to females is as 2·3 to 1, and registration is apparently very defective. In the towns generally, birth registration is more defective than in the country, rates varying between 61·73 and 44·91 in the little towns of Zigon and Kawkareik, and 18·61 in Akyab; where females constitute less than a fourth of the population. The average urban birth-rate was 24·19 against 33·14 in the rural circles. The average percentage of male to female birth was 107, ranging from 112 in Pegu and Mergui to 104 each in Prome, Henzada and Thayetmyo.

There were 120,565 deaths registered, as compared with 122,714 in the preceding year, yielding a death-rate of 21·74 per 1,000. The urban district of Rangoon, from which the lowest birth-rate was returned, furnished the highest death-rate, 33·17 per 1,000, being followed at a distance by Hanthawaddy (25·25), Henzada (24·45) and Mergui (24·22). The lowest death-rates were recorded in Toungoo (15·77), Tavoy (16·64) and Thaton (17·02). While the average recorded urban birth-rate was much lower than the rural rate, the average death-rate was higher in the towns (29·99) than in the country (20·62). The variation in the town death-rates, though considerable, was not excessive, the highest being 38·42 in Pegu, and the lowest 16·52 in Sandoway.

In each of the last six months of the year the number of recorded deaths was greater than in any of the first six months; the lowest death-rates being recorded in March, May and April, and the highest in August, July and December.

The death-rates among infants were 206·59 and 168·61 per 1,000 born respectively. In every age-period the male death-rate was the higher, the averages being 23·06 for males and 20·24 for females.

Christians, of whom the total number was 133,540, are shewn to have died at the rate of only 11·97 per 1,000, but this is manifestly wrong, for among 27,330 Christians in Toungoo district, only 50 deaths were reported. Buddhists and "Others" died at nearly the same rates, 22·13 and 22·36, respectively, but the death-rate of Hindus was 25·59 against only 16·26 among Muhammadans. The principal reason for this difference appears to be the fact that the majority of the Muhammadans are resident in the district of Akyab, where registration is very bad; and it is probable that mortality among Hindu immigrants is unduly high.

In Upper Burma births and deaths were registered in thirteen towns, and deaths were recorded in certain rural tracts also. The average birth-rate in the thirteen towns was 37·66 per 1,000, and the average death-rate 33·27; the birth-rates varying between 47·38 in Pakokku, and 23·36 in Minbu; and the death-rates between 35·80 in Mandalay, and 16·31 in Pagan. The Provincial Sanitary Commissioner is satisfied with the progress of registration in all the towns except Minbu; but, while the numbers returned may be not far short of the truth, greater accuracy in details might be expected; for instance, although the average percentage of male to female births in the thirteen towns was 105, the percentages ranged from 145 in Minbu, to 90 in Myingyan and Salin.

Ajmer-Merwara.—The average number of births recorded during a year in Ajmer-Merwara in the quinquennium ending with 1900 was 15,431; in 1900 the number registered was 7,958, and in 1901 the number has fallen to 7,679, equal to a birth-rate of 16·10 per 1,000. The percentage of male to female births recorded was 119·15, as compared with 123·79 in 1900. The number of deaths registered in 1901 was 15,798 against 65,067 in the preceding year, and the death-rate 33·13 per 1,000 as compared with 119·97 in 1900. The urban death-rate was 39·06, as compared with 30·91 in the country. Hindus and Muhammadans died at the rates of 35·42 and 31·56 respectively. Male infants died at the rate of 236·9 per 1,000, registered births and female infants at the rate of 254·6. Between the ages of 10 and 40 females died at a greater rate than males, the averages for the sexes being 33·15 for males and 33·10 females.

History of the Chief Diseases.

Cholera.

Just as in the case of enteric fever, one of the chief difficulties with regard to suspected water examined, is the rarity (not so great as in the case of enteric fever) of finding the true microbe and the frequency of finding microbes like it. There is the same kind of doubt as to how far these cholera-like microbes may be dangerous, and whether they may not be a stage of existence of the true comma. Heim has called attention to the value of a blood decoction as an addition to his original enrichment process for the detection of the cholera microbe in water. The statements of Firth that in India he found the danger signal of cholera in water to be the presence of a large number of fluorescent vibrios, and that previously healthy waters in which these vibrios suddenly appeared were certain to cause an epidemic of cholera in a few weeks, require confirmation. It has been pointed out in Egypt from actual experience that specimens of stools, &c., which in the fresh state readily yield the vibrio, may after the time spent on a twenty-four hours' journey to a laboratory give but a negative result. The use of potassium permanganate for the disinfection of wells has, as usual, been frequently resorted to during the year; but though opinion on the whole is favourable, there is no proof of its efficacy; and it may be mentioned that recent experiments tend to throw discredit on present chemical means of water purification. The importance of flies in the spread of the disease, symbiosis as a

factor in cholera causation, and the fresh vigour which cholera is supposed to have acquired about the year 1817, are all old points which have lately been brought up again, L. Rogers has extolled the leucocyte count as a simple and rapidly applied guide in diagnosis and prognosis.

Deaths from Cholera in the different Provinces in India from 1877 *to* 1901.

YEAR.	Bengal.*	Assam.	United Provinces of Agra and Oudh.	Punjab.	N.-W. Frontier Province.	Central Provinces.	Berar.	Madras.	Coorg.	Bombay.	Lower Burma.	Upper Burma†	Ajmer-Merwara.	Rajputana.	Central India.	Hyderabad.	Mysore.
1877 ..	155,305	11,377	31,770	29	—	3,418	842	357,430	‡	57,228	7,276	—	11	60	926	7,414	2,902
1878 ..	95,192	6,732	22,221	215	—	40,985	34,306	47,167	49	46,743	6,759	—	210	2,393	8,047	6,696	723
1879 ..	130,363	17,415	35,892	26,135	—	27,575	223	13,296	—	6,937	1,828	—	120	918	2,734	6	14
1880 ..	39,643	2,083	71,546	274	—	330	1	613	—	684	2,638	—	3	—	299	—	25
1881 ..	79,180	5,010	25,865	5,207	—	9,140	3,404	9,446	3	16,694	5,239	—	16	197	581	1,721	25
1882 ..	182,352	21,055	89,372	39	—	11,932	3,573	23,604	31	7,904	7,177	—	289	1,327	1,562	150	893
1883 ..	90,439	14,908	18,160	190	—	16,235	27,897	36,284	—	37,954	2,185	—	87	797	1,740	1,947	124
1884 ..	134,421	22,276	30,143	614	—	149	87	75,476	—	13,804	5,515	—	227	1,297	1,018	2,479	336
1885 ..	173,767	7,753	63,457	1,936	—	21,868	3,683	58,109	—	37,287	7,685	—	100	1,615	4,624	1,387	2,677
1886 ..	118,368	20,188	34,565	12	—	16,679	976	12,417	—	167	4,027	—	765	173	290	499	10
1887 ..	172,578	7,941	200,628	8,804	—	12,576	14,396	28,359	3	25,711	2,649	—	384	2,612	8,868	2,831	832
1888 ..	111,391	9,693	18,704	14,938	—	921	305	58,677	2	36,500	15,982	—	13	32	191	2,057	1,015
1889 ..	171,103	18,288	48,494	2,838	—	52,588	10,925	76,020	9	32,431	3,240	—	55	6,923	3,344	1,128	1,590
1890 ..	145,885	15,396	80,295	3,401	—	4,787	847	35,288	5	3,259	1,076	—	403	2,746	3,132	—	1,326
1891 ..	129,575	23,882	169,013	10,107	—	21,312	7,958	98,773	7	17,850	2,400	—	532	2,946	13,474	3,102	1,204
1892 ..	259,398	21,552	194,886	75,959	—	39,972	2,030	79,033	58	42,900	6,208	—	2,352	26,760	8,384	53	5,497
1893 ..	126,976	21,849	12,154	639	—	557	1,188	32,209	9	18,853	2,393	—	3	314	127	165	680
1894 ..	236,150	13,497	178,079	113	—	7,043	3,462	42,289	8	33,588	7,428	—	—	2	5,210	1,862	328
1895 ..	177,087	18,962	51,562	549	—	15,506	11,919	21,172	—	8,890	5,150	—	289	1,049	6,043	467	2,334
1896 ..	226,824	17,042	69,147	5,146	—	52,985	12,264	47,847	49	35,404	2,959	—	12	3,797	15,766	525	2,100
1897 ..	196,247	33,240	44,208	622	—	57,131	10,122	143,445	106	57,109	8,538	—	19	1,496	13,202	1,039	4,248
1898 ..	65,020	11,149	2,508	33§	—	7	—	65,444	8	4,368	2,972	—	1	6	2	6	1,193
1899 ..	107,678	8,330	8,142	1,816	—	76‖	541	29,082	—	8,579	4,942	2,050	1	498	—	—	123
1900 ..	345,878	23,761	84,960	28,260	—	63,114	18,375	60,662	—	163,889	3,440	41	4,842	28,719	20,450	3,813	779
1901 ..	110,753	7,468	53,995	180	117	49	17	81,370	58	13,600	3,552	¶1	50	6	72	1	11,351

* Excluding Calcutta from 1877 to 1892.
† Statistics from 1877 to 1898 not available.
‡ Statistics not available.
§ Including 30 deaths in Cantonments.
‖ Excluding Zamindaries.
¶ In selected towns only.

Cholera in India.—The cholera mortality of India in 1901 was reduced from that of 1900 by over 67 per cent., and was less than in four of the six years preceding, of which 1900 had the highest ratio, and 1898 and 1899 the lowest. There was a decrease in every month of the year, except January; but the diminution was greatest in March-August. Every province had a lower ratio, except Madras and Coorg, the difference being greatest in the Central provinces and Berar. The three highest ratios were, in order, those of Bengal, Assam, and the United Provinces. No province was quite free. Further details are given in the paragraphs below.

Burma.—In Lower Burma during the ten years, 1892–1901, the highest registered death-rate from cholera was 1·89 per 1,000 in 1897 and the lowest 0·53 in 1893, the ratio of 1901 being 0·64. The districts which suffered most in 1901 were Prome, Thongwa, Myaungmya, and Amherst; and urban mortality was highest in Kyaiklat, Danubyu, Yandoon, and Pegu. Two districts and sixteen towns returned no deaths. The fact that the fatality comes to 98 per cent. of cases indicates that non-fatal cases were not often reported. In the selected towns of Upper Burma only one death was recorded.

Assam.—The mortality from cholera in Assam was less than half the average for the last fifteen years; and the actual number of deaths was lower than in any year of the preceding nineteen. I wish, says the Sanitary Commissioner, I could think that this favourable result was due to improved sanitation and efforts made by the people to cleanse their surroundings, but I cannot. There was a succession of small epidemics in the Cachar and Kamrup districts. In the Lakhimpur district more than half the deaths

occurred in tea-gardens, and there was also a smart outbreak, causing 182 deaths, in the railway camp at Tipling Ghat. The Nowgong district, which had been severely visited in 1900, registered but few deaths in 1901. The highest district ratios were those of Kamrup, Cachar, and Lakhimpur ; and the highest town ratios those of Silchar, Dhubri, and Karimganj. For tea-gardens the ratio of mortality was 2·17 per 1,000. The number of tea-garden cooly immigrants fell off considerably, but the proportion of deaths occurring amongst them while in transit from Goalundo to the port nearest to the place of their employment also diminished ; and the Sanitary Commissioner ascribes this to greater precautions taken on the steamers and to greater care exercised not to ship infected coolies. This may be so, but rates as low have occurred before.

Bengal.—Only six times in the twenty-four years preceding is the number of deaths from cholera in Bengal seen to be less than in 1901, though the 1900 mortality had been the highest on record. Nevertheless, the disease visited every district except Ranchi in 1901, attacked 18,806 villages, and assumed an epidemic form in 43 areas. The highest district ratios were those of Puri, Cuttack, and Balasore all in the Orissa Division ; and the highest town ratios those of Maheshpur, Ghatal, and Revelganj. Excepting in Puri, Balasore, Midnapur, Chittagong, and Hazaribagh, the district mortality was everywhere lessened, and only ten districts had a death-rate of over 2 per 1,000. In the absence of fuller explanation, the remarks of the Sanitary Commissioner on the connexion between deficient rainfall and cholera are somewhat obscure. The medical officer of Puri traces the outbreak in epidemic form to the contamination of the drinking water at Balunga *mela* held in Pipli circle ; and the medical officer of Balasore to importation by pilgrims *en route* to and from the Jagannath festivals at Puri ; but in neither case are materials offered for the formation of a critical opinion on these statements. The disease prevailed throughout the year in Orissa, was never prevalent in Chota Nagpur, and in Bengal proper was somewhat severe in January-May and in December. "Good results" were reported from twelve districts from the disinfection of wells with potassium permanganate. In the Mazaffarpur district applications were actually made for a supply of the disinfectant, but in some other districts its use was strongly objected to. The subject of inoculation will be mentioned below. Among the European seamen of the port of Calcutta there were 5 deaths from cholera, and 63 in the native floating population.

United Provinces.—The number of deaths from cholera in the United Provinces, though much lower than in 1900, was otherwise higher than in any year since 1896 ; and the ratio was higher than that of the lustrum. The mortality reached its maximum in October. The highest district mortalities were those of Hardoi, Rai Bareli, and Lucknow, all in the Lucknow Division ; and the highest town mortalities those of Sahatwar, Bilgram, and Barhaj. The districts of Almora and Hamirpur were free, and the number of deaths in Dehra Dun was only five. Details are not given of the reported efficiency of potassium permanganate for the disinfection of wells ; but the benefit in times of cholera is mentioned of the appointment of a couple of Brahmans or Khsattriyas to draw water for all from an uninfected or disinfected well.

Punjab.—In only five years, of which two were 1894 and 1898, in the twenty-four years preceding were there fewer deaths from cholera in the Punjab. The ratio also was only one thirty-second of the quinquennial mean. The mortality in the preceding year had been heavy. The districts of Umballa and Karnal and the towns of Jagadhri and Sujanpur had the highest mortality ratios. Only 35 towns or villages in 32,834 registered deaths, and the maximum number was 36 in Jagadhri in the Umballa district. The first three cases there were among persons who had returned from Hurdwar, where cholera was reported to be prevalent. Though the disease did not assume a severe epidemic form, it was present in the town for about two months.

North-West Frontier Province.—In the North-West Frontier Province also cholera was much diminished, the ratio being 80 per cent. below that of the lustrum. The districts of Kohat and Bannu were free throughout the year. Most of the cases occurred in the Peshawar district, and chiefly in Tangi village, the first of the 62 cases in Tangi being that of a man who had come from the Swat village where cholera was prevailing. A few cases also appeared in neighbouring villages. The first of Peshawar city's 24 cases was derived from Tangi ; and it is stated that after ninety-one wells had been treated with potassium permanganate the disease stopped.

Bombay Presidency.—In the Bombay Presidency the cholera mortality ratio was about 74 per cent. below the mean of the previous five years, and about 92 per cent. less than in 1900. Sind was entirely free, and Gujarat nearly so. In January cholera was continuing in five districts from the previous year, the epidemic reached its maximum in April, and in July a further extension of the disease took place. The affected area included 916 villages out of 25,846, and the mean percentage of deaths to attacks was 60·16. Much the highest district mortality ratio was that of Dharwar, and the three next highest were all from the same Registration District. The highest town ratios were those of Kaladgi, Ranebennur, and Gokak, all in those districts. The Deputy Sanitary Commissioner of the Registration District says that the wide diffusion of the disease in the preceding year made it impossible to ascertain the origin of the first cases of 1901, that the disease has been endemic for the last ten years, and that, as usual, it was propagated by human intercourse from village to village amid grossly insanitary conditions.

Berar.—Only in two years of the preceding twenty-four, 1880 and 1898, had there been fewer cholera deaths than in 1901. The ratio was 99·9 per cent. below that of the preceding year, and also much below the quinquennial mean. In the district of Akola there were 43 cases with 16 deaths. The outbreaks in the villages of Rail and Dhad were attributed to contaminated water, while that at Dongergaon originated at a feast held by Dheds, thirteen being attacked and two dying. Potassium permanganate was employed to disinfect all wells and polluted sources.

Central Provinces.—A reduction of 99·8 per cent. took place in the cholera mortality of the Central Provinces, and only once in the preceding twenty-four years had the number of deaths been less. The ratio of 1901 was also over 99 per cent. less than the lustral mean. The districts of Narsinghpur and Nimar and the town of Khapa had the highest mortalities. The outbreak at Narsinghpur was ascribed to the arrival of pilgrims from Mathura, where cholera was prevalent. The origin of the first outbreak at Nimar could not be traced; but in the second the disease was imported by a wedding party from an infected village in Indore. The first case in Raipur was a woman returning home from a pilgrimage. Sporadic cases occurred in Nagpur and Chanda.

Madras Presidency.—An increase of a little over 18 per cent. took place in the mortality of the Madras Presidency as compared with that of the previous year, and a slight increase as compared with the quinquennial mean. The number of deaths had been higher only in three of the preceding twenty-four years. The highest district ratios were in Salem, Anantapur, Cuddapah, and North Arcot; and the highest town ratios in Vaniyambadi, Arcot, Ramnad, Calicut, Ambur, and Nandyal. The Sanitary Commissioner points out that the towns which chiefly suffered in mufassal areas, have water supplies open to fæca pollution, and that in Madras town the inhabitants are allowed to supplement the public water-supply by the use of innumerable wells sunk in a foul subsoil and open to pollution. He also complains that local authorities are not yet alive to the necessity of taking action before the cholera is actually upon them, and that they are prone to allow economy to interfere with efficiency.

Coorg.—There had been no cholera in Coorg for two years when it broke out again in 1901, causing 58 deaths. The first outbreak occurred towards the end of April in the Mercara taluk, the disease being imported by a Mappilla coming from South Canara. A second slight outbreak occurred in November, the disease making its first appearance in villages on the South Canara border. In other cases also the infection was traceable directly or indirectly to South Canara.

Cholera inoculation.—At Purulia during the year 3,335 inoculations were performed among the cooly emigrants proceeding to the tea gardens of Assam, 58 among those proceeding to Trinidad, and 60 among the population of a Manbhum village during an outbreak. Out of 275 uninoculated coolies on board the steamers plying between Goalundo and Dibrugarh in February and March, 8·36 per cent. got cholera, ten of the cases ending fatally; while out of 414 inoculated coolies only 1·2 per cent. contracted the disease, and none died of it. If inoculations were performed elsewhere, the fact is not mentioned.

Small-pox.

The mortality ratio of India from small-pox was the same as in 1900, and somewhat below the quinquennial ratio. All the months of the year, except the first three and August, showed a greater number of deaths. The total number of deaths in the preceding year (excluding Mysore and Upper Burma) had been 84,780, and in the year before that 49,113. There was very little small-pox in the towns of Upper Burma. The increase in Assam was chiefly due to several outbreaks in the Sylhet district; and the medical officer reported that most, if not all, of these followed the visits of inoculators, and that the people objected to be vaccinated with bovine lymph. The provincial Sanitary Commissioner supports him in calling for a more extended application of the Act against inoculation. Not for at least 25 years had there been so high a mortality from small-pox in Bengal as in 1901, and it was higher in every district except eight. Inoculation, says the civil surgeon of Cuttack, in which the disease seems to be increasing in virulence, is carried on throughout the district, and thus the disease is spread: when the outbreak of smallpox is mild in character, children are wilfully exposed to the disease; and when these return to their own villages an outbreak results, which is not confined to those thus exposed, but spreads among the unprotected with disastrous results. In the port of Calcutta there were three deaths among European seamen and three in the native floating population. In the United Provinces and Oudh, on the other hand, the rate was the lowest on record, and no district or town had a high rate. Nearly two-fifths of the deaths from smallpox in the Punjab were reported from the districts of Montgomery and Jhang; while the Kangra district, said to be the best vaccinated in the province, had, as usual, a low mortality. Some of the municipal towns suffered very severely, and the Sanitary Commissioner complains that the municipal committees do not take enough interest in vaccination. The civil surgeon of Bannu in the North-West Frontier Province brought to the notice of the authorities that the large number of cases in the district was due to inoculation freely carried on by Pathan inoculators, and steps were taken to put a stop to the dangerous practice. Though the death-rate in the Bombay Presidency was not high, Kanara and Ahmedabad were the only collectorates free from the disease. At the outward and inward inspections 30, and on board vessels lying in the harbour or docks of Bombay city 4, cases of smallpox were detected. The death-rate in Berar was low. The disease was more prevalent in all the districts of the Central Provinces except Betul and Chanda. The epidemic was a continuation of the previous year's outbreak, and began to wane in June, but waxed again in October-December. The Madras Sanitary Commissioner considers that the high mortality in the town of Cochin was due to the fact that it adjoins an area under independent native administration. In Coorg the death-rate from smallpox was high.

Statement showing the deaths from Small-pox registered in the different Provinces by Months during the year 1901.

Provinces.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Ratio of deaths per 1,000 of population.	
													1901.	1901.	1900.
Bengal	2,922	3,026	4,037	6,402	4,699	3,637	3,235	1,932	1,569	1,409	1,284	3,478	37,630	0·50	0·29
Assam	157	114	266	417	445	396	339	197	124	153	209	457	3,274	0·62	0·18
United Provinces*	54	44	73	142	150	161	140	67	28	16	40	66	981	0·02	0·03
Punjab	546	433	460	553	865	600	669	380	265	221	389	713	6,154	0·31	Not available.
North-Western Frontier Province.	120	74	130	77	89	116	81	67	24	34	58	77	955	0·47	
Central Provinces†	772	662	890	808	823	564	417	215	85	90	135	220	5,681	0·66	0·74
Berar	28	16	31	34	33	12	9	6	1	2	1	17	190	0·07	0·29
Lower Burma	184	272	407	349	297	264	206	124	126	93	60	81	2,468	0·44	0·58
Upper „ ‡..	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Madras Presidency	2,535	2,570	2,648	2,539	2,244	1,939	2,049	1,823	1,884	1,788	1,905	2,278	26,202	0·72	0·84
Bombay „	602	625	924	896	649	464	394	250	125	77	108	226	5,340	0·29	0·52
Ajmer-Merwara	—	—	1	—	1	—	—	—	—	—	—	2	4	0·01	4·81
Coorg	68	94	54	21	25	38	94	26	14	1	6	8	449	2·48	1·81
Total	7,988	7,930	9,971	12,238	10,320	8,251	7,633	5,087	4,255	3,889	4,193	7,623	89,378	0·40	0·40

* Late North-Western Provinces and Oudh. † Excluding Chhattisgarh Zamindaries, ‡ Towns only.

Plague.

For India as a whole there was a great increase in plague mortality, an increase of over 67 per cent. It will be seen in the table on page 102 that the principal provinces of India, with their native states, shared in the increase. On the other hand Assam, the North-West Frontier Province, Baluchistan, Ajmer-Merwara, Central India, Berar, and Coorg returned no deaths, though the two last had each a fatal "suspicious case." The plague of the Central Provinces and Burma was entirely imported.

A few fragmentary notes will now be given on various points regarding plague, before the mortality for the disease in each province is considered.

Difficulty of Diagnosis. Rats and other Animal—The chief points mentioned by Power as having been brought out by Low in his study of Plague reports from all parts of the world, are the comparative slowness with which plague becomes acclimatized to new conditions; the difficulty of diagnosing the first occurring cases of plague, owing to its mimicry, as it were, of indigenous maladies; and the apparently varying relation of rats to the spread of the disease. The following words of his might have been written from a study of the Indian reports: "The records to which Dr. Low has had access, though they go to confirm belief that as regards plague man and rat are reciprocally infective, fail completely in affording sufficient data for determining the degree to which man is in danger through the rat. So far as plague ashore is concerned, it would appear that in particular localities man and the rat suffered from plague coincidently, that in other localities man suffered before the rat, and that in others again the rat suffered antecedently to man. Further, it would appear that when in a particular district the one (man or the rat) has suffered plague antecedently to the other, the interval between invasion of the first and of the second species has been often a long one, extending sometimes over weeks and months. Finally it would appear that plague may prevail largely among men without rats becoming conspicuously affected; and conversely that the disease may cause large mortality among rats of a locality while neglecting to attack its human inhabitants. As regards plague on shipboard very similar facts were forthcoming. The disease does not, under conditions of sea transit, appear to be at all readily conveyed from the rat to man or from man to the rat. On the one hand ships plague invaded for several weeks in the persons of crew or passengers have come into port with the rats on board them seemingly altogether exempt from disease; and on the other hand, ships infected with plague-smitten rats have, after voyages of considerable duration, arrived at their destinations wholly free from plague as regards crew and passengers." That rats play a part in the spread of the disease is considered by Kolle and Martini as the most important lesson of the present outbreak in the world. The rat and not man, says Davies, is the primary sufferer from plague, and it is by the rat, and perhaps by the rat alone, that plague is spread; human plague is preceded by the epizootic, and the real danger to importing countries lies with plague rats, not with plague-stricken men; the infected rat is mainly distributed through the world by ships; local diffusion is but little due to contact with plague-stricken persons, and the only prophylactic of much value is the destruction of rats and their nests, burrows and habitual haunts; the recrudescence of plague in a city means that the disease is probably present as an epizootic, and that its further spread is independent either of the sanitary condition of the locality where the sporadic human cases have happened to occur, or of the incubation period of plague in the human subject; "contacts" now mean not those who have been exposed to human plague but those who may become exposed to rat infection. So, according to Kolle and Martini, rats are to plague what water is to cholera, plague is as much (if not more) a rat disease as a human pest, and plague is a disease of rats which only occasionally attacks man. Maxwell in Changpoo estimated that men were attacked about a week after the rats. In Manilla about 1·7 per cent. of the rats captured were found infected with plague. But in Glasgow, though rats were plentiful, they seem to have escaped, and nearly 300 of them were examined for the plague bacillus in vain. Again, Edington and also Schilling have described epidemics among rats not due to the real plague bacillus; Klein has demonstrated in the bodies of dead rats taken from a ship arriving at Bristol a microbe like the plague bacillus but with cultural characters between those of *B. coli* and those of *Bact. lactis aerogenes*; Tartakovsky has pointed out that the common pseudotuberculosis bacillus of rodents is very like the plague bacillus; and Galli-Valerio urges that confusion in the diagnosis of plague by the inoculation of guinea-pigs might arise from the fact that the *B. pseudo-tuberculosis rodentium* might be present in the guinea-pigs, the two bacilli exhibiting many points in common. An important case was reported in which a ship

sailing from a port not at that time known to be infected had at the end of 29 days of the voyage a minority of her rats affected; and two men ultimately fell ill. Another ship left an infected port and was disinfected, but plague appeared in 27 days from the time of leaving the infected port, and infected rats were found on board. From January to March of one year at Marseilles the rats of 7 out of 44 ships were found infected. Kossel and Nocht, on the other hand, found dead plague rats on board a steamer in which no human plague cases had occurred. Other animals which for the first time have been found to be infected are bats, wallabies, and kangaroos, and in all the infection was supposed to have been conveyed by fleas.

Fleas.—When hungry fleas, says Zirolia, are allowed to suck, they void blood in streams two or three times, to make room for filling themselves again and again, and thus sow the bacillus over the skin; also the bacilli remain alive and virulent in the fleas for about a week, and during this time may be found in their excrement. Laveran and Mesnil have shown that the flea seems to take a part in the transmission of trypanosoma from rat to rat. The life cycle of the flea, according to Howard, is complete in 17 days. In Egypt, Kolle personally experienced the possibility of taking away fleas on his clothes from plague dwellings without being any the worse, and he and Martini think the importance of insects in the spread of plague has been over-estimated by Simond and Ashburton Thompson; their own experiments with animals were negative; fleas containing plague bacilli went over to sound animals without infecting them; they agree with Nuttall and Galli-Valerio: the flea question appears to them rather academical, as there are so many ways in which infection might pass from rat to man; the fact of the transference of infection from rat to man is more important than the question as o how it is transferred. In the words of another, that the parasites of the plague-infected rat, although charged with plague bacilli, do actually cause plague in man has not been proved, but is the only link in the cycle of evidence actually wanting. Goodall remarks that the parasites of the mammalia are rarely interchangeable. In former reports it has been shown how Galli-Valerio failed to make rat fleas bite him. He has lately published an account of what has been done on the subject, and concludes that so far from its being possible to assert as an established fact that plague is transmitted to man by the bites of the fleas of rats and mice, and that this is the most frequent and important means of infection, it requires to be demonstrated not only that the fleas pass from rats and mice to men but that they pass from rat to rat. In these views Galli-Valerio has, of course, the support of Nuttall.

Measures against rats and insects.—The chief advance in the method of securing the destruction of rats and insects appears to be the Clayton process, which could be used on land as well as on shipboard, and the most recent experimental evidence in its favour is that of Calmette and Hautefeuille, who used a ship in their tests. The Clayton gas is a mixture of the sulphurous and sulphuric anhydrides. Haldane also reports favourable results from carbonic oxide, and others have found carbonic anhydride of use. But these methods require to be perfected, in view of certain difficulties which are met with in practice. For rooms Fulton and Stokes recommend hydrocyanic acid gas. The method of Danysz continues to meet with faint praise, though Wiener, like Bronstein, states that its virulence can be raised by the use of alkalinized medium. The same procedure can be used for Issatschenko's and Grimm's bacilli, which are considered to be identical.

The bacillus. Hardiness, viability, or survival.—Caldas holds that the plague bacillus is but a rat colon bacillus of high virulence. Klein has shown that the bacillus of Danysz and that of Gärtner are indistinguishable except by habitat, both belonging to the colon group; and in the discussion on his paper Foulerton and MacFadyean were quite prepared to consider them identical. Again, Voges states that in the dead bodies of rats there is some difficulty in distinguishing the bacillus of Danysz from the plague bacillus. In the same way, Tartakovsky and also Galli-Valerio have pointed out that the *B. pseudo-tuberculosis rodentium* is very like the plague bacillus morphologically and culturally; and the former found that it forms stalactites indistinguishable from those of the plague bacillus. Another caution as to bacillary diagnosis is given by Rosenfeld, who finds that other bacilli give involution forms on salt agar, though a careful and experienced observer can distinguish those of plague from the others. Galli-Valerio, however, points out that the involution forms of the glanders bacillus are very like those of the plague bacillus, and suspects that in both cases the so-called involution forms are really normal developmental forms. Sata found that up to the fourth day after death t

bacilli could be isolated from bodies by cultivation, but that animals could still be infected for about 16 days; and the experience of Kolle and Martini was that they perished in 10–14 days. Old cultures that had been preserved for from twenty months to four years were discovered by Schultz to be still virulent.

Experiments on animals. Mode of entrance. Mode of spread.—The delicacy of the skin-rubbing method (referred to in former reports) for the detection of the plague bacillus suspected to be present in any medium has been extolled by Kolle and Martini, Dürck, and Fritsche. The first-named found it demonstrate the presence of that bacillus when cultivation and ordinary inoculation had failed. Fritsche states that it is the only one of hæmorrhagic septicæmic group which kills when so inoculated, and that it enters by the lymphatics, while anthrax enters by the hair follicles, and the pneumococcus by the capillaries. Kolle and Martini's experiments showed that passage through the rat, mouse, or guinea-pig, especially if the infection had been effected by inhalation, enhanced the virulence of the plague bacillus, but not passage through the rabbit. As Kolle and Martini say, while plague patients do not directly infect, except in the pneumonic form, they are nevertheless dangerous. Speaking of his experience in South Africa and India, Blackmore asserts that in no case was their direct evidence of conveyance from man to man, but that rats and fleas, and sometimes soil, were necessary intermediaries. Voges, like others quoted in former reports, found the bacillus in the sputum in certain cases, even after convalescence had been established, and even when there was no pneumonia discovered the bacillus in the mouth and pharynx. The danger of this to men and rats is obvious. Schottelius also states that the bacillus may be found in the sputum and bronchial secretion of the majority of plague cases, at least when they have become septicæmic before death. The view that man derives the disease from the soil—the order of infection being rat, soil, man—is strongly urged by Farrar.

Mahamari.—Whether it be the case or not, as quoted by Sticker, that the homes of the original conveyers of plague are discovered in the colonies of the Asiatic marmot; the observations of Chayton White have made it almost sure that *mahamari* is plague. In studying an outbreak in Garhwal, he was able to show with an approach to certainty that the disease had not been imported from the plains; and he succeeded in obtaining from patients smears and cultures in which the plague bacillus was identified by Hankin, Haffkine, and himself. Specimens were sent to Europe for further examination.

Bengal.—There was increased prevalence of plague throughout Bengal, severest in Calcutta, in all the districts of the Patna Division except Chumparan, in Monghyr of the Bhagalpur Division, and in Hazaribagh of the Chota Nagpur Division. As in the previous year, the Patna Division, and especially the district of Patna, suffered more than any other, and it also suffered more than in 1900. The disease was first imported into a village near Barh in September, 1899, and gradually spread, chiefly in the most densely populated areas. The epidemics in the Saran, Gaya, and Monghyr districts were continued from 1900. The districts of Shahabad, Muzaffarpur, Darbhanga, Sonthal Parganas, Hazaribagh, Palamau, and Manbhum were infected during the year from the districts of Patna, Gaya, and Saran. The direction in which plague spread, says the Sanitary Commissioner, is very characteristic; it generally followed rapidly along trade routes and main routes, and very slowly indeed in purely agricultural parts. Seasonally the epidemic followed the same course as in the preceding year; it was comparatively quiescent during the hot weather and rains. With regard to the district of Saran, however, it is noted that while the towns attacked remained almost free in the second half of the year, in the rural areas the disease continued throughout the year. The people readily resorted to evacuation, but were against disinfection. Inoculations were performed in the Saran, Monghyr, Gaya, and Patna districts; but only in Gaya district was the number very large, some of the educated natives in Gaya town being themselves inoculated and promoting the measure. The Sanitary Commissioner asserts that not infrequently houses shortly after disinfection have been reinfected by persons or rats. He is of opinion that man is the chief agent in the spread of the disease, and that inoculation is a more useful measure than disinfection.

City and port of Calcutta.—There was the usual exacerbation in the beginning of the year, attaining its height in the week ending 23rd March. It began earlier than in 1900, reached its maximum earlier, and subsided more rapidly. As before, Ward V. was the first to show the recrudescence. The epidemic was, if anything, less severe; and the apparent increase is attributed to greater success in finding cases. There was a special tendency among Mussulmans to conceal cases, especially female cases The facts

were believed to indicate that the infection is one of locality, though the cases do not always occur in the same houses in successive outbreaks. One of the most striking features of the epidemic was the marked intensity of the outbreaks in dal and grain godowns. Though the Special Health Officer himself does not believe in the agency of rats, his assistants are strongly impressed with the importance of the part they play. The Special Health Officer believes that the disease is but slightly contagious, and that both rooms and men are probably infected through the medium of airborne dust; that dark haunts of the disease which cannot be disinfected should be destroyed; that otherwise disinfection is the best measure against plague, because it renders the house at once habitable, and reinfection is rare, at least in the same epidemic or within six months. One hundred and eight vessels arriving from plague-infected ports were boarded, but no cases of plague were found, though four of the vessels were "suspected ships," and were quarantined until they had been disinfected. No "infected ships" arrived in port, and no cases were detected among the crew or passengers of outward-bound vessels, though some of the rejected persons may have afterwards developed the disease.

Statement showing the deaths from Plague Registered in the different Provinces by Months during the year 1901.

Province or State.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total. 1901.	Total. 1900.
Bengal	9,238	15,065	30,786	17,570	2,521	270	79	133	332	429	720	1,486	78,629	38,412
Assam	—	—	—	—	—	—	—	—	—	—	—	—	—	—
*United Provinces of Agra and Oudh.	31	454	3,792	2,889	659	7	—	—	89	244	276	1,333	9,778	* 135
Punjab...	101	198	525	1,857	1,700	507	123	36	153	1,274	3,622	6,624	16,720*b*	572
North-West Frontier Province.	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Punjab Native States (Kapurthala, Patiala, Nabha).	—	—	—	369	413	26	—	2	11	85	556	695	2,157	19*a*
Jummu and Kashmir State.	—	4	26	108	140	41	4	2	8	65	558	887	1,852	—
Central Provinces ..	—	—	1	2	—	—	—	—	2	1	—	3	9	590
Berar	—	—	—	—	—	—	—	—	—	—	—	—	—	2
Burma	—	—	—	1	1	—	1	—	—	—	—	—	3	3
Madras Presidency ...	166	413	283	95	33	20	27	41	62	151	372	1,372	3,035	664
Bombay „ ...	2,587	5,832	8,000	4,814	3,345	2,291	5,135	11,057	19,925	25,193	21,971	18,109	128,259	33,196
Bombay Presidency (Native States).	420	568	890	907	475	367	1,358	2,896	5,552	6,550	5,710	4,128	29,821	5,172
Baluchistan	—	—	—	—	—	—	—	—	—	—	—	—	—	* 2
Ajmer-Merwara ...	—	—	—	—	—	—	—	—	—	—	—	—	—	2
Rajputana, Marwar State, Jaipur State, Sirohi State.	1	22	110	40	2	—	—	—	4	2	1	3	185	10
Central India	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Coorg	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mysore	1,146	793	579	242	119	269	713	1,068	1,451	1,714	1,823	2,019	11,936	13,375
Bengalore Civil and Military Station.	378	226	134	37	17	14	11	11	18	22	152	235	1,255	—
Hyderabad State ...	25	7	3	—	—	—	—	—	1	2	—	111	149	653
Total ...	14,093	23,582	45,129	28,931	9,434	3,812	7,451	15,250	27,608	35,732	35,761	37,005	283,788	92,807
Calcutta City	204	934	3,810	1,919	401	130	61	86	61	79	93	105	7,883	2,681
Bombay „	1,606	3,846	4,675	2,453	1,151	312	431	881	1,045	788	775	731	18,694	15,874
Madras „	1	1	1	—	—	—	—	—	—	—	—	—	3	—

* Late North-Western Provinces and Oudh.

(*a*) Patiala only.

(*b*) This table has been submitted by the Chief Plague Medical Officer, Punjab, and differs from that shown in the Sanitary Report for 1901.

United Provinces.—Plague was prevalent in the districts of Benares, Ballia, Allahabad, and Jaunpur; small outbreaks occurred in Agra, Mirzapur and Azamgarh; and scattered cases were reported from Partabgarh, Ghazipur, Sitapur, and Gorakhpur. In the middle of January the disease broke out almost simultaneously in the Benares and Ballia districts. The first outbreak in Benares prevailed chiefly in the city and in a village in its vicinity and lasted to May, while the second began in October and subsided in December. In the city the classes trading in food-stuffs were particularly affected. Inoculation was purely voluntary, and the number inoculated up to August was only 1,172. The second outbreak was confined to the city, and is believed to have proceeded from foci established during the first. The first case in Ballia is understood to have occurred at Raniganj, a large market town having trading relations with the infected Saran district, and by the end of the year the disease had appeared in 66 villages. In the Allahabad district the source of the infection was not traced, but the first cases appeared in March in a village near Mau Aima, and Mau Aima had suffered from plague in the preceding year. The disease had fairly established itself in Allahabad city in September. At the end of the year plague was still gaining ground in the district. To Jaunpur the pest spread in the month of March. The Agra cases were, with one exception, confined to the city and its suburbs, and the disease was successfully stamped out. Mirzapur was infected by refugees from Benares. In four villages of the district of Garhwal 23 fatal cases of *mahamari* were observed.

Punjab and Kashmir.—The enormous increase of mortality from plague in the Punjab is ascribed by the Sanitary Commissioner to the relaxation of all compulsory measures; and the disproportionate mortality among females to the fact of their being more in the infected houses than the men. But the monthly progress of the disease was not unlike that recorded in other provinces. The great majority of the deaths were reported in the districts of Jullundur, Hoshiarpur, Gurdaspur, and Sialkot. In the Jullundur district a great extension of the disease occurred in March, and though the number of cases diminished in the hot weather, there was not the usual complete cessation. The Hoshiarpur district remained free till March, when it was reinfected from the Jullundur district, and after that the disease did not entirely disappear. The plague of the Gurdaspur and Sialkot districts was continued from the preceding year, and increased greatly in the earlier months of 1901. In all these districts the second extensive rise began in September. The vast majority of the cases were of the bubonic type, though some were pneumonic or septicæmic. A mild and less fatal form is said to have prevailed in two tahsils where inoculation had been largely performed. As far as the Chief Plague Medical Officer could obtain information, infection of villages seemed in nearly all cases to be due to human intercourse, directly or by means of clothes, &c., and in no instance could proof be got of the introduction of the infection by rats, though in many villages large numbers of dead rats were seen before the disease had spread.

Plague in the Jammu province of Kashmir was imported from the adjacent British districts of Gurdaspur and Sialkot. It began in February in the village of Rara, and up to the 7th July fifteen more, including the town of Samba, had become infected. On the 21st August the disease, which had died down, reappeared in the village of Chhanni, and afterwards in other villages; and towards the end of December it reached the city of Jammu. The epidemic was at its worst in the months of November and December. It is stated that infection was generally observed to pass readily from patients to their attendants or even visitors, so long as the former remained in their dark and ill-ventilated houses; but that after their removal into tents or chhappars in the open, the number of attendants who took the disease from their sick charges was strikingly insignificant. About twice as many women were affected as men, which was ascribed principally to their being more in the house than men. The Kashmir plague authorities believe "dessication" to be superior in efficacy to chemical disinfection.

Madras Presidency, Madras city, and Mysore.—In the Madras Presidency, the towns of Vaniyambadi, Bellary, and Ambur suffered most. Bellary was infected by cases imported from the Bombay Presidency and concealed by householders. Elsewhere the infection was derived directly or indirectly from Mysore territory, no less than 120 cases having been removed from trains at the Jalarpet inspection station alone. In connection with certain investigations of one of the civil surgeons, the Sanitary Commissioner suggests that the possibility of primary infection of the intestine through water may perhaps require investigation. The question has also been raised in Madras whether under special circumstances certain kinds of snakes may not be susceptible to plague.

There was no epidemic in the city of Madras. No information is available as to the progress and features of the plague in Mysore, but plenty of correspondence as to the measures which were or ought to have been taken there.

Bombay Presidency.—In the Bombay Presidency the number of towns and villages affected was 1,582 against 587 in the previous year ; and the mortality was the highest recorded since the first appearance of the disease in 1896. All the collectorates in the presidency were affected except Thar and Parkar, Larkhana, and Upper Sind Frontier, those suffering most being Belgam, Dharwar, Satara, and the city of Bombay, with death-rates between 34 and 19. Then came Karachi, Broach, Surat, Poona, and Thana, with rates between 7 and 4 per 1,000. In the collectorate of Khandesh the number of deaths rose from 8 to 2,676, and in that of Kolaba from 140 to 1,116.

City and port of Bombay.—In the city of Bombay plague was present throughout the year, the maximum being in March, with a secondary maximum in September. During the month of January there was a rapid increase in the epidemic pervading every district. The people had grown so accustomed to the plague that there was absolutely no panic of any kind ; the plague staff met with no opposition ; and in many cases the people showed that they appreciated disinfection and evacuation. With equanimity and resignation they bore the epidemic, which from the 26th February to the 19th March exceeded in virulence all previous epidemics. Points brought out in the report of the Municipal Commissioner are that those actually engaged in combating the plague were impressed by the part played by rats ; that disinfected houses were frequently reinfected, sometimes, at least, by rats ; and that houses which had cases in 1900 were apt to have them again in 1901. On more than one occasion dead rats sent to the Plague Research Laboratory were found to contain plague bacilli. It was noticed that vagrants were not so frequently attacked as formerly.

At the outward and inward inspections and on board vessels lying in the harbour and docks, 73 cases of plague were detected ; 51 at outward inspections, 3 at inward inspections, and 19 in harbour. Among the passengers and crew sent to the Port Observation Camp, 51 developed plague ; but in consequence of the rigour of the examination and disinfection, few persons actually suffering from fully-developed plague symptoms attempt to leave Bombay by sea. Three cases occurred on outward vessels. The question of the method of clearing ships of rats was under consideration.

Rajputana.—The village of Bali in the Marwar State contains a large number of banias who carry on business with Bombay, and there is constant intercourse between the two places. On the 25th of January a bania arrived from Bombay, and walked about the village during the day, but was found dead next morning. In February plague broke out, and lasted till the 15th April. In March the disease appeared in Sewarhi, about eight miles from Bali, and did not stop till the 15th May. In the two villages 6,820 inoculations were performed. Sixteen of the inoculated persons were subsequently attacked, and eight died.

Hyderabad State.—There was less plague in His Highness the Nizam's dominions than in any year since 1897, and during half the year they were free from it. One of the cases in February and the cases in September and October were imported. The districts of Aurangabad and Kopbal recorded 145 out of the 149 deaths. The plague of Aurangabad lasted from January to March, declining from January, and broke out again in December. That of Kopbal did not appear till near the end of the year.

Fevers.

The fever mortality of India (calculated on the census population of 1901) was 18·1 per cent. lower than that of the previous year (calculated on the census population of 1891), and 10·5 per cent. below the quinquennial ratio ; the number of deaths falling from 4,860,790 to 4,174,919. The decrease affected all the months of the year, except February, August, and December, and was greatest in October. If the mortality of each of the two years had been calculated on the census population of 1901, the decrease would not have been quite so great. Than Lower Burma only Madras had a smaller death-rate, and the ratio was less than usual. A pamphlet was issued to local authorities and medical subordinates on the etiology, prevention, and treatment of malaria. The sale of quinine from post offices and by private vendors and vaccinators

was somewhat less than in the previous year. Urban fever mortality in Upper Burma was greatest in October, November, and December. In Assam fevers were more prevalent than in 1900, and this is believed to be the reason why the sales of quinine increased. The total given for fevers includes 5,856 deaths from kala azar, of which 4,792 occurred in the district of Darrang and Nowgong. The disease has almost disappeared from the Goalpara district, and is much lessened in Kamrup. Sibsagar and the North Lakhimpur sub-division have escaped. In Darrang a few fresh villages have become affected; but in Nowgong only chronic cases come for treatment, and some parts of the district are reported free. The extent of the disease in the Sylhet district was not discovered until a thorough inspection had been made by a hospital assistant specially deputed for the purpose. Hislop has reported the finding of cases of Malta fever among natives in Assam; while Bentley, from a study of cases of *kala azar*, has come to the conclusion that *kala azar* is Malta fever. But this conclusion has been assailed by L. Rogers and by Dodds Price, both adversely criticising the clinical and therapeutic evidence offered, and the former specially condemning the serum testing

Statement showing the deaths from Fevers in the different Provinces by Months during the year 1901.

PROVINCE.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL.	RATIO OF DEATHS PER 1,000 OF POPULATION.	
													1901.	1901.	1900.
Bengal	15,940	121,195	142,384	161,700	115,153	97,187	114,615	99,349	124,939	132,802	144,092	211,363	1,617,019	21·72	23·97
Assam	5,953	5,602	5,698	6,623	7,678	7,989	8,803	7,879	6,979	6,483	6,734	7,475	83,696	15·86	14·70
United Provinces*	76,529	65,957	76,330	81,689	91,584	84,202	81,134	79,928	105,783	127,214	122,395	126,232	1,118,977	23·46	23·58
Punjab	46,420	27,030	25,344	22,502	31,269	33,307	30,494	29,002	48,742	70,504	73,730	69,691	508,035	25·26	Not available.
North-West Frontier Province	2,957	2,393	2,135	1,986	2,375	2,324	2,031	2,141	2,009	2,393	3,157	3,208	29,108	14·23	
Central Provinces†	13,135	10,898	10,735	8,710	9,014	8,396	7,318	8,619	10,259	13,998	13,166	12,922	127,170	14·66	28·70
Berar	3,421	2,763	2,766	3,055	2,879	1,857	1,748	2,432	3,736	4,941	4,466	3,784	37,848	13·93	29·45
Lower Burma	4,133	3,714	2,967	3,022	3,181	3,321	4,627	4,683	4,146	4,171	4,564	5,461	47,990	8·65	11·18
Upper „ ‡	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Madras Presidency	24,982	21,775	21,026	20,906	20,926	21,838	23,240	25,346	26,392	28,200	27,962	32,261	294,854	7·90	8·74
Bombay „	31,970	28,175	32,579	24,534	19,926	16,147	15,676	18,285	21,434	25,952	28,835	28,438	291,951	15·80	28·87
Ajmer-Merwara	2,990	1,261	1,079	810	942	615	396	501	967	993	1,127	1,408	13,089	27·45	31·56
Coorg	436	407	350	390	521	525	515	553	418	359	317	391	5,182	26·69	27·97
Total	364,566	291,175	323,393	335,921	305,448	277,708	290,597	278,518	355,804	418,010	431,145	502,634	4,174,919	18·73	22·87

* Late North-Western Provinces and Oudh. † Excluding Chattisgarh Zamindaries. ‡ Towns only.

procedure and results.* The Sanitary Commissioner of Bengal believes that the "fever" mortality of the province was unduly raised by the inclusion of plague deaths; that the fevers prevailing throughout Bengal are chiefly malarial in nature; and that the comparative immunity of urban areas is due to better water-supply arrangements and greater facilities for medical aid. There was a falling off in the number of packets of quinine sold; but the largest sales were effected in the months of usually greatest fever prevalence. In the native floating population of the port of Calcutta 33 deaths took place from fever, and 2 from enteric fever among the European seamen. In the United Provinces the mortality, a great deal of which was really due to malaria, but some to plague, &c., was somewhat reduced. The Sanitary Commissioner is inclined to think that money will be better spent in improving surface drainage and filling in tanks and depressions than in organizing so-called mosquito-brigades. Nearly five times as many packets of quinine were sold as in the previous year, the most successful agency being the post office; and the price was reduced towards the end of the year. In most districts of the Punjab there was a decrease of death from fever, especially considerable in those districts which had suffered most severely in 1900. The people of the five districts where mortality was highest had suffered from a severe famine, immediately followed by a destructive epidemic of malarial fever; so that in their weakened state of health they were unable to resist the

* See also Bassett-Smith in J. T. M. of 2nd February, 1903, page 37.

attack of a mild epidemic in 1901. The attention of civil surgeons and district officers was called to the necessity of draining or filling up all small pools of water in the vicinity of towns and villages, and of encouraging the use of quinine. Arrangements for the free distribution or sale of quinine in the Punjab do not seem to be very far advanced. Besides the jail and regimental cases, it is probable that unrecognized cases of cerebrospinal fever may have been occurring in the civil population. The fever mortality in the Bombay Presidency was low; and the high ratios of Ahmedabad and other four collectorates were considered to be, to a great extent, due to famine causes. Four cases of enteric fever and 227 of other infectious fevers were detected by the Bombay Port Health Officer. The fever mortality in Berar was much reduced. In the Central Provinces too the mortality fell greatly. Practical measures are contemplated for the prevention of malaria. Meantime the sale of quinine has been increased; schoolmasters, stamp vendors, and patwaries have been added to the list of agents; and the price has been reduced. The fevers which caused death in the Madras Presidency are considered to be chiefly malarial; and every effort, though apparently not often with much success, was made to induce local bodies to act upon present knowledge as to the part played by the mosquito. The Sanitary Commissioner offers evidence of the occurrence of enteric fever even among pure natives, and of water-pollution sufficient to account for it. According to him, statistics in the Madras Presidency show that the more perfectly water-supply has been extended to a town, the less is the fever rate, notwithstanding that, in the absence of drainage systems, it is exceedingly likely that anopheles pools have been much increased. Coorg registered an increase of fever mortality; and the greater prevalence of fever, as well as the reduction in the price of the drug, may have been a causative factor in the marked increase in the sale of quinine.

Dysentery and Diarrhœa.—The mortality ratio for bowel complaints for India was less than half that of the preceding year, and the number of deaths fell from 523,292 to 247,054. The ratio was also about 26 per cent. below the quinquennial mean. The decrease ran through all the months of the year, but was most marked in July-September. The towns returning the highest mortalities in Lower Burma are said to be those which

Statement showing the deaths from Dysentery and Diarrhœa registered in the different Provinces by Months during the year 1901.

PROVINCE.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL. 1901.	RATIO OF DEATHS PER 1,000 OF POPULATION. 1901.	1900.
Bengal	6,611	4,755	4,988	5,373	4,384	3,703	4,457	4,268	5,155	4,964	4,441	6,544	59,643	0·80	0·91
Assam	884	738	746	981	1,125	914	1,106	1,072	1,058	1,001	1,037	914	11,576	2·19	2·84
United Provinces*	1,777	1,386	1,402	1,786	2,093	2,162	2,116	2,553	3,161	3,069	2,949	2,718	27,172	0·57	0·65
Punjab	1,272	738	585	665	932	864	782	1,069	1,781	2,412	1,950	1,672	14,722	0·73	Not available.
North-West Frontier Province	14	20	19	30	41	36	40	30	39	55	30	26	380	0·19	
Central Provinces†	1,235	1,025	835	639	592	655	748	883	1,027	1,063	893	795	10,390	1·20	5·16
Berar	1,542	1,074	866	717	677	510	637	1,072	1,466	1,368	1,087	837	11,853	4·36	22·39
Lower Burma	546	564	614	565	646	710	1,160	1,134	625	656	420	511	8,151	1·47	1·84
Upper‡ „	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Madras Presidency	3,504	2,848	2,445	2,237	2,451	2,855	3,731	4,779	4,288	3,984	4,327	4,635	42,084	1·13	1·18
Bombay „	5,042	4,649	5,086	4,440	4,335	4,261	5,238	6,364	6,276	5,286	4,657	4,564	60,198	3·26	11·59
Ajmer-Merwara	185	97	59	40	16	25	14	41	46	40	42	62	667	1·40	13·90
Coorg	18	11	7	17	26	30	44	19	16	6	11	13	218	1·20	1·19
TOTAL	22,630	17,905	17,652	17,490	17,318	16,725	20,073	23,284	24,938	23,904	21,844	23,291	247,054	1·11	2·45

* Late North-Western Provinces and Oudh. † Excluding Chattisgarh Zamindaries. ‡ Towns only.

generally head the list, and in which, in addition to overcrowding and its attendant evils, there exist permanent sanitary defects in connection with conservancy, drainage, and water-supply. As in former years, the rates for the Darrang, Sibsagar, and Lakhimpur districts are much heavier than those for Goalpara and Kamrup; and investigation has not yet succeeded in suggesting a satisfactory explanation. The highest mortalities of Bengal were those of the same sixteen districts as in the preceding year, though with

changes in order. Bowel-complaints generally prevail among the scantily clad people in the cold weather, probably as a sequel to malarial fever. One death occurred among the European seamen, and five in the native floating population of the port of Calcutta. It is usual for Garhwal to have the highest mortality among the districts of the United Provinces. The Sanitary Commissioner of the Punjab connects the decrease of dysentery and diarrhœa with the diminution of malarial fever ; and the highest mortalities of 1901 were lower than those of the same districts in 1900. In the Bombay Presidency the decrease was considerable, was shared in by all the months of the year, and was probably connected with the diminished area of famine. In Bera the decrease was great. All the districts of the Central Provinces, except four, had lower death-rates. The higher ratio in municipal towns than in rural areas is explained by the Sanitary Commissioner of Madras as illustrating the effect of the aggregation of human beings upon filthy and sewage sodden soil, with contaminated water-supply. The increase in Coorg may have been due to the concurrence of cholera. Nearly half the total occurred in May, June, and July.

Vaccination.

Vaccination in India.—During the year under review the conditions which affected the work of the Vaccination Department so adversely in 1900–01 had for the most part passed away. Scarcity, however, still lingered in Bombay ; and except in the Central Provinces there was a great extension of plague in the affected provinces, particularly in Bombay and the Punjab. In Bombay it was considered prudent not to push vaccine operations in the plague-affected areas ; but in the Punjab, in view of the repeated recrudescence of the disease, it was resolved not to suffer the infected districts to remain unprotected from small-pox any longer, so in future years, it may be hoped, that vaccination will again progress.

The aggregate number of operations performed in 1901–02 was 8,036,414, which is 162,052 more than in the preceding year, but 88,893 less than in 1899-1900. Six provinces divide the increase, but in unequal shares. Work progressed most in Bengal and Madras ; and in the United Provinces, Assam and Berar the increase as compared with the preceding year was satisfactory ; but in Ajmer-Merwara the increase was inconsiderable. Five provinces show a further falling off. Chief among them is Bombay where the decrease is nearly 140,000 ; then comes Burma with a decrease of nearly 60,000 ; and then the Punjab (with which for purposes of comparison with last year the figures relating to the new North-West Frontier Province are here included) with a decrease of more than 40,000 ; then the Central Provinces with 30,000 ; and, lastly, Coorg where the decrease was upwards of 2,000. The presence of plague and the effect of famine caused the decline in Bombay and the Punjab, and the effects of famine affected work in the Central Provinces. No reasons are given for the falling off in Coorg, nor is the serious decline in the work in Burma fully explained. It may, however, be inferred from the Burma report that the decrease in the reported number of operations performed is mainly due to the prevention of falsification of their returns by the vaccinators.

The number of primary operations performed during the year was 7,358,744, or 123,724 more than in 1900–01, and the number of re-vaccinations was 677,700, or 38,328 more than in the previous year. There was a great falling off in the number of re-vaccinations in Assam, from 20,247 in 1900–01 to 9,412 in 1901–02.

The average degree of success obtained in the country generally was somewhat higher in both primary operations and re-vaccinations than in the preceding year, the percentages being 94·97 and 65·5 in 1901–02, against 94·5 and 64·4 in 1900–01. The highest percentages of success in primary cases were claimed in Ajmer-Merwara, 99·21, and Bengal, 98·01 ; and the lowest in Burma, 90·11, and Madras, 89·41. The percentages of success in re-vaccination ranged from 83·93 in the Central Provinces, 81·55 in the United Provinces, and 81·09 in Assam, to 51·0 in Burma, and 18·3 in Berar.

Included in the foregoing figures are the 210,277 operations performed at dispensaries. That total is 4,927 in excess of that of 1900–01, and in most provinces, except notably Coorg and Burma, there was a small increase. The vast majority of the operations, 145,661, were performed in Bengal, and except in Assam, the Central Provinces, Madras, and Burma, dispensary vaccination is either non-existent (Berar and Ajmer) or trifling in amount.

The proportion of the population protected during the year varied between 49·15 and 44·46 per 1,000 in Coorg and Assam, respectively, and 21·49 per 1,000 in Bombay, the average proportion being 31·3, as compared with 31·8 in 1901; the apparent falling off being due to the computation of the ratio for 1901–02 on the higher population figure of the 1901 census.

Total Primary and Re-vaccinations, successful cases among the children, cost of the Special Vaccination Department, &c., during the official year 1901–02.

PROVINCE.	NUMBER OF PERSONS VACCINATED BY THE SPECIAL AND DISPENSARY STAFFS COMBINED.		PERCENTAGE OF SUCCESSFUL CASES TO TOTAL OPERATIONS.		NUMBER OF CHILDREN SUCCESSFULLY VACCINATED BY THE SPECIAL AND DISPENSARY STAFFS COMBINED.		Average number of operations performed by each vaccinator of the Special Staff.	Total Cost of the Special Department.
	Primary.	Re-vaccinations.	Primary.	Re-vaccinations.	Under One Year.	One to Six Years.		
								Rs.
Bengal	2,529,778	133,048	98·01	67·07	775,729	1,482,590	950	1,87,818
Assam	271,415	9,412	97·48	81·09	64,747	175,835	978	22,776
United Provinces of Agra and Oudh	1,490,996	89,199	96·02	81·55	873,598	486,009	1,757	1,42,447
Punjab	511,121	157,023	93·92	58·47	377,482	92,008	2,527	92,045
North-West Frontier Province	63,321	7,672	91·03	75·18	32,194	20,325	2,369	11,281
Central Provinces	350,484	74,908	96·58	83·93	211,296	94,902	1,473	48,267
Berar	82,296	38,122	96·6	18·3	62,432	14,292	2,867	17,626
Madras Presidency	1,235,196	89,910	89·41	69·00	356,467	581,875	1,584	2,55,099
Coorg	8,416	1,356	93·50	74·26	905	4,063	1,050	2,719
Bombay Presidency	471,233	50,473	91·98	59·92	323,745	98,252	1,222	2,70,741
Burma	333,657	26,567	90·11	51·00	80,448	156,890	1,829	79,137
Ajmer-Merwara	10,831	10	99·21	80·00	8,032	2,421	723	2,301
TOTAL	7,358,744	677,700	94·97	65·50	3,167,075	3,210,362	1,182	11,32,257

Vaccination operations performed by the Special and Dispensary Establishment separately, deaths from Small-pox, etc., during the official year 1901–02.

PROVINCE.	Population.	NUMBER OF PERSONS VACCINATED (PRIMARY AND RE-VACCINATIONS COMBINED).			Ratio of successful vaccinations per 1,000 of population.	Percentage of annual estimated births at 40 per 1,000 of population successfully vaccinated.	DEATHS FROM SMALL-POX*.	
		By Special Department.	By Dispensary Staff.	Total.			Number.	Ratio per 1,000 of population.
Bengal	74,801,731	2,517,165	145,661	2,662,826	34·34	25·93	37,680	0·50
Assam	6,126,343	257,386	23,441	280,827	44·46	26·42	3,274	0·62
United Provinces of Agra and Oudh	47,960,667	1,579,795	400	1,580,195	31·37	45·54	981	0·02
Punjab	20,274,136	667,484	660	668,144	28·21	46·55	6,154	0·31
North-West Frontier Province	2,119,291	70,183	810	70,993	29·92	37·98	955	0·47
Central Provinces	11,873,029	410,235	15,157	425,392	33·80	44·49	6,081	0·63
Berar	2,897,040	120,418	—	120,418	29·9	53·88	190	0·07
Madras Presidency	38,227,818	1,311,255	13,851	1,325,106	30·51	23·31	26,202	0·7
Coorg	180,607	9,452	320	9,772	49·15	12·53	449	2·48
Bombay Presidency	21,576,105	518,977	2,729	521,706	21·49	37·51	5,340	0·29
Burma	10,478,617	352.976	7,248	360,224	23·98	19·19	2,468†	0·44†
Ajmer-Merwara	476,912	10,841	—	10,841	28·55	42·11	4	0·01
TOTAL	236,992,296	7,826,167	210,277	8,036,444	31·36	33·41	89,778	0·40

* For the calendar year 1901. † For Lower Burma only.

If we suppose that 40 children were born for every 1,000 of the population, 33·41 per cent. of them were protected by vaccination during the year, against 33·9 per cent. in 1900-01, the percentages varying between 53·88 in Berar, and 19·19 and 12·53 in Burma and Coorg, respectively.

The average number of operations performed by a vaccinator in the year ranged from 2,867 in Berar, to 950 in Bengal and 723 in Ajmer-Merwara.

The average small-pox mortality was ·40 per 1,000 against ·41 in the preceding year. The death-rates ranged in the provinces from 2·48 per 1,000 in Coorg, where there were 449 deaths, and ·63 in the Central Provinces, where there were 6,081, to 02 in the United Provinces, where the deaths numbered 981, and ·01 in Ajmer-Merwara, where they numbered only 4.

The aggregate cost of the department was £75,484 or about £1,400 less than in the preceding year; and the cost of each successful case varied between 9 annas and 4 pies in Bombay, and 1 anna and 2 pies in Bengal, the average being 2½ annas, or 1 pie less than in 1900-01.

Nature of the vaccine used.—The methods of carrying on vaccination in the different provinces are not uniform. In Madras, Assam, Berar and Burma calf lymph is used, generally mixed with either lanoline or glycerine. In Bengal fresh and lanolinated calf lymph is used, but the majority of operations are performed with human lymph taken directly from the arm. In the Punjab buffalo calf lymph made into a paste with sterilized vaseline is the vaccine in use. In Bombay and the United Provinces glycerinated calf lymph is used to a limited extent, but the vast majority of the operations are done with human lymph taken directly from the arm in Bombay, and preserved on ivory points in the United Provinces. In the Central Provinces human lymph, fresh calf lymph, calf lymph mixed with glycerine and calf lymph mixed with lanoline are all in use.

The length of time that preserved calf lymph will retain its efficiency, and whether lanoline or glycerine is the best preservative are questions regarding which diversity of opinion still exists. So far as the somewhat unsatisfactory data at hand enable one to form an opinion, lanolinated lymph will keep better than glycerinated lymph, but probably much depends upon the lymph used and the conditions of manufacture, while when different lymphs come to be tested the effect of the varying skill of vaccinators must not be left out of account.

Both glycerinated and lanolinated lymph will, however, keep sufficiently long in any season of the year to admit of distribution in any province from a central depôt situated in the province. In more than one of the provincial reports there are complaints regarding the quality of the lymph-supply. This should not be. The encouragement of vaccination creates an obligation to provide vaccine, the use of which not only affords protection against small-pox, but is free from danger and inconvenience.

Bengal.—The total number of operations recorded in Bengal was 2,662,826, against 2,346,311 in the previous year, and 2,252,521 in 1899–1900. Primary cases numbered 2,529,778 and re-vaccinations 133,048, the corresponding figures in the previous year being 2,227,942 and 118,369. It is satisfactory to note that while a larger number of operations were performed, the standard of success rose from 97·8 to 98·0 per cent. in primary work, and from 59·2 to 67·07 per cent. in re-vaccinations.

Striking increases occurred in some districts, notably in Mymensingh which shows a rise of 43,215 cases; in two other districts the work increased by over 30,000 operations each. Four districts only show a fall, Dacca being the chief of these, where the decline was by 11,934 cases; this is, however, due to a sub-division of the district having been transferred to Faridpur.

It is computed that 32·06 per cent. of the infants available were protected in the province as a whole, while in the towns more than double, or 70 per cent., were successfully vaccinated, compared with 60 per cent. during the previous year. The ratio returned for towns is, however, in the present condition of registration, considered to be of doubtful value.

The results to the credit of the department during the year 1901–02 are satisfactory, especially as the superior staff, owing to other demands, was unable to extend the requisite amount of supervision to the work of vaccinators, who being mainly recruited from an ignorant class exercise but little influence with the people. The system under which licensed vaccinators do much of the work in Bengal has, it is said, rendered the department unpopular, while it is difficult for the vaccinators to recover their fees. The working of

the department is, however, being examined, and the question whether it would not be well to replace the existing licensed vaccinators by a paid agency is engaging special attention. The introduction of well considered measures of reform will no doubt effect improvement in the work done, and the opening of a training school for vaccinators at Cuttack, which has already passed out some trained vaccinators, will help to provide efficient men.

Small-pox prevailed in epidemic form during 1901, the ratio of deaths having been ·50 per 1,000 of population against ·29 per 1,000 in 1900. To this cause is in some measure due the increased amount of work recorded during the year under report.

The following table shows the results obtained with (1) human lymph and calf lymph, (2) free from admixture and (3) mixed with lanoline.

	Primary Vaccination.		Re-Vaccination.	
	No. of cases.	Percentage of success.	No. of cases.	Percentage of success.
Arm to arm	1,961,650	98·16	63,893	68·83
Calf lymph without admixture	323,884	98·56	35,134	75·74
Lanoline lymph	244,244	96·07	34,021	54·79

These results are an improvement on those recorded in the preceding year.

The inadequacy of the lymph supply, which is reported to be impeding work in many parts of the province, has been again mentioned by the Sanitary Commissioner who urges the establishment at an early date of the Animal Vaccine Depôt at *Pusa*, and this has been approved by Government. The establishment of another such depôt in Orissa is also recommended.

The Calcutta and Darjeeling Depôts continue to be worked satisfactorily, the lymph supplied from the former having been reported to be of very good quality.

The Nepal Darbar and the Sikkim State received, respectively, 675 and 560 grains of lymph during the year, but no detailed results were reported. For vaccination in Bhutan 50 grains of lanoline paste were supplied.

Inoculation is said to be very prevalent in Orissa and the punishment meted out to offenders being inadequate, it has so far not proved deterrent.

Assam.—The total number of operations in the province was 280,827, as compared with 271,466 in 1900–01, and 272,265 in 1899–1900. Primary cases numbered 271,415 against 251,219 in 1900–01 and re-vaccinations 9,412 against 20,247. While, therefore, primary work increased, re-vaccination declined, but the recorded percentages of success rose in both classes of work, from 96·0 and 80·0 per cent., respectively, to 97·48 and 81·09 per cent. The effect of local measures satisfactorily augmented the outturn of work done at dispensaries, and the steady increase in the number of primary operations performed by the tea garden agency was maintained.

In the province the protection afforded to infants is represented by 32·6 per cent. of the births recorded during 1901, compared with 25·4 per cent. protected during the preceding year; while in 11 towns, where the compulsory Vaccination Act continues in force, 80 per cent. of the available number of infants were successfully vaccinated, against 70 per cent. during the previous year. At Nowgong, one of the eleven towns, no less than 94 per cent. of the available children were protected, a result due to Captain McNaught's personal efforts.

The amount and quality of work done at the Animal Vaccine Depôt at Shillong during the year under report was the largest and most satisfactory on record. The total number of tubes loaded with vaccine was 395,317, as compared with 387,557 in the previous year. The quality of the lymph was generally excellent, although it is to be noted that the first supply in the Darrang District proved to be of inferior quality, probably due to the heat of the weather at the time it arrived in the district.

Inoculation is unfortunately still carried on, although it appears to be widely practised in only the Surma Valley Districts. Several outbreaks of small-pox in the Cachar and Sylhet Districts were distinctly traceable to inoculation. It is significant of the attitude

of the people that in one sub-division the inhabitants petitioned the Chief Commissioner to stop vaccination and authorise inoculation. In the opinion of the local Administration the province is not yet ready for the suppression of inoculation by law, and other than coercive measures must be depended upon to secure a discontinuance of the evil practice in Assam.

United Provinces of Agra and Oudh.—The steady progress which has attended vaccination in the United Provinces during the past five years was maintained, with the result that a total of 1,579,795 operations were performed by the special staff during the year, against 1,549,233 in 1900–01, and 1,511,436 in 1899–1900. Including 400 operations at dispensaries against 176 last year, the total for the province was 1,580,195. Of this number, 1,490,996 were primary cases and 89,199 re-vaccinations, the ratios of success being 96·02 and 81·55 respectively, as compared with 95·2 and 82·5 in the preceding year. It is satisfactory to note that both the quantity and quality of the work shows an improvement. The hill districts are specially well vaccinated, the people being anxious to be vaccinated and re-vaccinated three or four times.

The number of successful primary vaccinations in municipalities fell from 113,275 in 1900–01 to 110,455 in 1901-02, the decline being attributed to a smaller number of births during the latter year. Of 88,366 children under one year computed to be available in the towns, 85,640 were successfully vaccinated.

Bovine lymph depôts were, as usual, maintained at Lucknow, Bahraich and Allahabad. The outturn of work has not been stated, but the quality of the lymph was apparently good. Pure calf lymph and lanolinated calf lymph were both used, but not to any large extent.

Orders have been issued for the construction of the new bovine lymph depôt at Patwa Dangar (six miles from Naini Tal), which when in working order may be expected to provide a good lymph supply for the entire province.

Punjab.—Excepting the year 1899-1900, the decline in the number of operations in the Punjab has continued year by year since 1896-97. During 1901-02, the primary operations numbered 511,121, and re-vaccinations 157,023. These figures exclude those relating to the districts transferred to the North-West Frontier Province since November 1901, and are therefore not comparable with the figures relating to the Punjab published in previous reports. The percentages of success were 93·92 in primary vaccinations, and 58·47 in re-vaccinations, both lower rates than were recorded in the previous year.

The causes of the continued decrease in the amount of work done were practically the same as in the year 1900-01—a low birth-rate and sickness consequent on scarcity, which also affected the supply of buffalo-calves ; the continuance and spread of plague in the province necessitated the total suspension of vaccination in certain badly affected tracts, while the employment of the Deputy Sanitary Commissioner and vaccinators on plague duty interfered with the conduct of vaccination work.

The local government has decided that the existence of plague ought not to lead to the infected areas being left unprotected against small-pox, and efforts are to be made to carry on vaccination in those areas irrespective of the presence of plague.

The improvement of the prospects of the subordinate staff of the department by the introduction of a reorganization scheme which took effect from the 1st September, 1901, should result in better work and the recruitment of a better class of men in future.

No addition was made to the list of towns in which the Compulsory Vaccination Act is in force, and the administration of the law in many of them leaves room for criticism. But the improvement of vaccination in towns is engaging attention, and efforts are being made to persuade municipal committees to introduce the Act, and also to encourage the vaccination of children where the Act is not applied.

No details of work in the Native States of the province have been furnished, but it is stated that in Patiala and Kapurthala a decrease has occurred in consequence of the prevalence of plague.

Particulars are wanting with respect to the work of the provincial lymph depôt. Vaccination with vaseline lymph proved less successful than with fresh animal lymph, but this is attributed to the fact that the former was used in the warmer months when results are always poorer.

Circumstances compelled the postponement of trials with glycerine lymph, and also the conduct of experiments as to the protective power of vaseline vaccine paste. The re-appointment of a whole-time Deputy Sanitary Commissioner, and the provision of the necessary apparatus, will now admit of definite action being taken to carry out experiments.

North-West Frontier Province.—This province appears in this report for the first time, the figures for the districts which constitute it having hitherto been included in the returns for the Punjab. As in the Punjab, there has been a decline in the work of the Vaccination Department, the total operations being 70,993, as compared with 78,479 in 1900–01 and 81,583 in 1899–1900. The decline has occurred in the primary work only, re-vaccinations having increased during 1901–02 to nearly double the number performed in either of the two previous years. The details of the work done during 1901–02 show 63,321 primary cases and 7,672 re-vaccinations, against 73,614 and 4,865 respectively in 1900–01 : the percentages of success being 91·03 and 75·18 in 1901–02 and 92·75 and 66·87 in 1900–01.

It is stated that 2,174 vaccinations were performed in the Sherrani country, but whether these are excluded from the total returned for the province is not apparent.

It is of interest to note that the practice of vaccination is beginning to be appreciated by the tribesmen across the border, and the Bonerwals bring their children into British territory to be vaccinated.

Central Provinces.—The total number of operations performed by all agencies during the year 1901–02 amounted to 425,392, a decrease of 30,005 on the total recorded during the preceding year. Of the total, 350,484 were primary cases and 74,908 re-vaccinations, while in the year 1900–01 the corresponding figures were 385,493 and 69,904 respectively.

The foregoing figures include the work of the Feudatory State Vaccination Establishment and all the dispensary operations in the province. Excluding the latter, there were 269,270 primary operations in British districts and 68,738 in the Feudatory States during 1901–02, the corresponding figures for 1900–01 having been 303,559 and 67,004 respectively. The percentage of success declined in British districts from 97·13 to 95·87, and in the States from 96·23 to 95·93.

The re-vaccination work, however, exhibited an improvement, the number of cases in British territory rising from 52,054 to 53,409, but the percentage of success declined slightly from 84·94 to 83·56. In the States re-vaccinations increased from 14,979 to 18,818, and the ratio of success from 84·02 to 86·34 per cent.

The cause of the decrease in primary work in the British districts is attributed to a low birth-rate, the poor health of the people, and the closure of famine camps. In the States the increased outturn of work was due to the extension of vaccination to certain villages of the Patna State, where it had never before been attempted, and also to the prevalence of small-pox in parts of the Kalahandi State.

In dispensaries in British territory the number of primary vaccinations fell from 12,985 to 10,665 and re-vaccinations from 2,479 to 2,322. The percentage of success in the former, however, rose in the year under report from 92·34 to 94·62, and in the latter from 60·31 to 74·29. The causes of the reduced outturn of work are the same as noted above for the province. Owing to the absence of returns of dispensary vaccination from no less than seven Feudatory States' institutions no valid comparison of the work of the year 1901–02 with that of 1900-01 is possible.

The Vaccination Act continued in force in 35 out of a total of 45 municipalities, and in those 73·40 per cent. of the available children under one year of age were successfully vaccinated. The ratios vary considerably in the several towns.

As in 1900–01 nearly two-thirds of the operations were performed with animal lymph, and the percentage of success, 95·63, was identical with that returned the previous year. With glycerinated lymph the steady improvement noted last year was maintained, the percentage of success being 90·96 against 86·97 in 1900–01 ; while with lanolinated lymph the percentage of success declined from 99·51 to 88·81. The ratios of success obtained by the use of human (arm-to-arm) lymph were practically the same in both years, 95·11 and 94·66 in 1900–01 and 1901–02 respectively.

Berar.—Some of the ground lost owing to famine conditions during 1900–01 was regained during the year 1901–02, when a total of 120,418 operations were performed, or an increase of 12,630 over the total of the preceding year. There was improvement in both primary vaccination and re-vaccination, the numbers having risen from 74,707 and 33,081 in 1900–01 to 82,296 and 38,122 respectively in 1901–02. The percentage of success in primary operations was 96·6, which is the same as the ratio returned last year, and in re-vaccinations 18·3, against 20·9.

In the province 92·8 per cent. of the available infants were vaccinated ; and in 10 municipal towns 4,620 out of 4,922 infants were successfully operated upon.

Lanolinated lymph, manufactured at Amraoti, was used exclusively, and, while quite as efficacious as the pure calf lymph used in the previous year, was more economical.

Madras.—The total number of operations performed in the Presidency during 1901–02 inclusive of that at dispensaries, was 1,325,106 against 1,257,883 during 1900–01 ; the department thus maintaining the increase recorded last year. There was an increase in both primary operations and re-vaccinations, due partly to the extension of vaccination in local fund areas, and partly to the recovery from the falling-off brought about by the plague scare. Still, in nine districts there was a decrease, in explanation of which incompleteness of staff is urged as the main reason, while insufficiency or inertness of lymph is also advanced in some cases. The remedy for the former lies with local boards, while as to the latter the establishment of the new vaccine depôt which is being built ought to remove all cause of complaint.

The ratio of success in the total work is practically identical with that of the previous year, viz., 89·4 and 69·0 per cent. during 1901–02 and 89·2 and 69·7 during 1900–01 in primary vaccination and re-vaccination respectively.

Notwithstanding the comparatively satisfactory state of affairs which these figures exhibit, it has been shown that the increased work of recent years has not kept pace with the growth in the population, particularly in respect of the infant population. In municipalities an average of 66 per cent. of the available children were afforded protection, although in 47 towns, against 42 last year, the ratio was 75 per cent. But the number of children said to be available in towns is believed to be much fewer than was actually the case, and the effort made to secure better registration and more work on the part of vaccinators will, it is to be hoped, tend to improvement.

Coorg.—Notwithstanding the prevalence of small-pox in 1901–02, the number of operations declined from 12,049 in 1900–01 to 9,772, of which 8,416 were primary cases. The cause of the decrease has not been stated. In the dispensaries 320 persons were vaccinated against 669 in 1900–01. The percentages of success attained in 1900–01, 93·2 and 74·7 in primary operations and re-vaccinations respectively, were practically maintained in 1901–02, when the percentages were 93·5 and 74·2.

The vaccination of children above six months of age is compulsory in five municipal areas in Coorg, and from the results returned it is considered that the provisions of the law were adequately enforced.

Bombay.—The total number of operations in the Presidency was 521,706, and the decrease as compared with the returns of the preceding year amounted to 139,333 cases. The decline occurred in both primary operations and re-vaccinations, and is stated to be mainly due to a low birth rate consequent on the incidence of both famine and plague. The quality of the work done, however, shows an improvement, as the percentage of success in primary cases was 91·9 against 90·8 in 1900–01, and in re-vaccinations 59·9 against 56·9. The percentage of cases in which the results were unknown fell to 6·71 per cent. compared with 8·12 per cent. in the previous year.

The work in native states fell off considerably, from 133,720 primary cases in 1900–01 to 51,356 in 1900–01, and from 9,756 re-vaccinations to 8,404. The success in the former was 95·2 per cent. as compared with 92·6 in 1900–01, but in re-vaccinations it was slightly less—69 5 against 70·0.

That more work was done in the dispensaries in 1901–02 than in the preceding year was chiefly due to an increase at Bushire.

The quality of the lymph supply is reported to have been good—human and bovine lymph were both used. The ratios of success attending the use of former ranged in the several registration districts from 93·37 to 86·8 per cent. With the latter the ratios ranged from 89·8 to 70·88 per cent.

Glycerinated lymph was used in the Presidency circle only, with a success of 73·4 per cent., and lanoline paste in the southern registration districts only, the rate of success being 79·4 per cent.

Burma.—The number of operations performed in the province was 360,224, which represents a decrease of 59,687 cases as compared with the preceding year. Of this total, 333,657 were primary cases and 26,567 re-vaccinations, as compared with 392,305 and 27,606 respectively during 1900–01. The percentage of successful primary operations was very slightly lower, viz., 90·1 against 91·2 in 1900–01, but the success in re-vaccination was greater, 51·0 as compared with 49·9. No reasons for the reduced

outturn of work have been advanced, but it may be gathered that more effective supervision of the operators and closer examination of the returns have prevented falsification of the latter, which even now the Local Government declares to be unworthy of trust.

Inoculation is said to be freely carried on throughout the province, but the best way to induce the Burman to accept vaccination is to make it effective. The unfortunate occurrence of a conviction by a township officer of an inoculator being thrown out on appeal to the chief court has had an undeniably hampering effect on the department. The average small-pox mortality in Burma during the quinquennial period ending 1900 was 7·74 per 1,000 of the population, as against 4·02 in the quinquennium ending with 1895, so that the need of fostering the work of vaccination is abundantly evident.

There were 20,347 children available for vaccination in towns ; of these 17,757 were successfully vaccinated—probably a marked improvement on the real results of the previous year.

Calf lymph is used generally throughout Burma, resort being made to arm-to-arm vaccination when the supply of animal vaccine fails. Of the three lymph depôts, that at Taunggyi was closed in June, 1901, owing to a failure in the supply of calves, and the establishment transferred to Rangoon. In Rangoon, also, the supply of calves failed owing to the prevalence of cattle disease, and a new depôt was opened at Meiktila in February, 1902. Work is being carried on there in a hired house, but the construction of a suitable building will soon be begun.

Besides the locally made vaccine, supplies of vaccine were obtained from Bangalore, which generally proved more active than that manufactured locally.

Ajmer-Merwara.—There has been little improvement in this small British tract in Rajputana in the vaccination work recorded during 1901–02 as compared with the year 1900–01, when there was a great falling away from the results of the previous year. The number of operations performed during the year under report was 10,841, of which 10,831 were primary operations and only 10 re-vaccinations, the corresponding figures during the preceding year being 10,660 and 21 respectively. The success in primary operations was the same in both years, viz., 99·2 per cent. ; in re-vaccinations it rose from 61·9 to 80·0 per cent.

Civil Sanitary Works.

Bengal.—Excluding Calcutta, there were 155 municipalities in Bengal, an increase of two, namely, Budge Budge and Panihati, as compared with the preceding year.

The total income of the municipalities during the financial year ending on the 31st March, 1901, including an opening balance of £40,100, was £332,000, or £19,500 more than in the previous year, the increase being due to larger receipts from loans, grants from provincial and local funds, and contributions from private individuals.

The total municipal expenditure on sanitary purposes was 44·48 per cent. of the income, or £147,000, including £16,400 on water-supply, £13,400 on drainage, and £77,520 on conservancy ; the expenditure under the last two headings showing increases, as compared with the previous year, of sums of £4,684 and £5,468 respectively. On original sanitary works, as opposed to maintenance, the total sum spent was £28,040, only 13 municipalities devoting over 10 per cent. of their incomes to this purpose, while a large number spent less than 1 per cent.

Among the more important works completed or in progress were the following :— The Manicktolla municipality caused pipes to be laid from the Calcutta main at Sealdah, along the Beliaghatta road, for the extension of the filtered water-supply. The Krishnagar municipality caused the silted up Anjona channel to be re-excavated and bridged, at a cost of £988, to secure the efficient drainage of the town. At Darjeeling the fencing in of the water-supply catchment area at Senchal was completed. The Patna municipality carried out the scheme for flushing drains in the Pirbahar Mohulla at a cost of £2,800. At Gaya a tramway line, for the removal of filth, was constructed and maintained by the municipality at a cost of £839.

In rural areas the total cost of sanitary works completed or in progress was £40,346, against £33,100 in the preceding year.

Only one meeting of the Sanitary Board was held during the year, but the usual consultative work was carried on by the circulation of files among the members.

The principal subject of discussion at the meeting was the septic tank system of sewage disposal and its adoption by municipalities. From the report it would appear that action is being deferred pending the receipt of information regarding the fate of pathogenic germs in their passage through the septic tank.

The following are among the more important estimates prepared and considered by the Board:—

1. A detailed plan and estimate for an additional filter-bed for the Burdwan water-works.
2. A combined scheme for water-supply to all the riparian municipalities on both banks of the River Hooghly, contemplating a daily delivery of eight gallons of filtered water a head for a population of 285,000, at a capital cost of about £270,000 and an annual cost of £4,000, was prepared. This being considered too expensive, another scheme was drawn up under the orders of Government for the supply of unfiltered water to 17 of the towns at a cost of about £217,000. Both schemes are now before Government.
3. A scheme for the supply of unfiltered water to Wards I and II of the Narayangunge municipality at a cost of £11,934.

The opinion of the Board was requested on schemes for the drainage of Titaghar, English Bazar, Dinajpur, Monghyr, Baranagore, and Manicktolla.

The Manicktolla drainage project includes the complete surface drainage of the town at a cost of £31,800, and presents considerable difficulties as the main outfalls discharge into tidal water.

The Board also advised regarding schemes for the supply of filtered water to the Garden Reach municipality; for the extension of the Howrah water-supply; and for remodelling the Darjeeling water-supply; and dealt with a large number of miscellaneous references.

Assam.—The total income of the municipalities, towns, stations, and unions in Assam, excluding four small towns in the Surma Valley which have no separate income, was £14,942. The aggregate of the sums devoted to sanitation was £8,262, or 55·29 per cent. of the total income, as compared with 44·69 per cent. in the preceding year. On conservancy £4,864 was spent, or considerably more than half the total; on water-supplies £1,480; on drainage £730; while the balance was spent on vaccination (£84), markets and slaughter-houses (£575); and £470 on various sanitary improvements. The largest share of municipal income devoted to sanitation was 89·77 per cent. at Dhubri. The municipalities of Gauhati and Tezpur and the Habiganj union spent upwards of 65 per cent. of their incomes, while all the other bodies spent upwards of one-third, except municipality of Goalpara and the Golaghat union, which is at the bottom of the list with 24·68 per cent.

No work of capital importance was undertaken during the year, and most of the expenditure on new work was in connection with improvements to the water supplies.

Although papers were circulated to the members whenever this was thought necessary, the Sanitary Board held only one formal meeting during the year.

United Provinces of Agra and Oudh.—No details regarding municipal or district board income, or of the expenditure on sanitation, are furnished in the provincial report. It does not appear that any new project of importance was undertaken during the year, although something was done towards the improvement of existing works and schemes.

At Agra it was found that there was danger of pollution of the water-supply, by a village situated about a mile above the intake, and enquiries were in progress to ascertain if it was possible by the construction of a spur running into the bed of the river to effect a slight deviation of the current so as to avoid the village. Owing to the increase in the demand for water, an extra settling tank was constructed. At Cawnpore the drainage and sewerage scheme is still under contemplation; but the construction of main and low-level intercepting sewers has been commenced. A city improvement scheme, providing for widening the worst streets, improving thoroughfares, and constructing new streets, is under consideration. At Lucknow it is hoped that the new sewerage and drainage scheme, which is under consideration, will soon be begun. At Farrukhabad a

drainage scheme to cost £5,000 was being carried out. At Aligarh the construction of outfall drains for sullage was in progress. For Dehra Dun a detailed scheme for the improvement of surface drainage was prepared.

The great water-supply works continue to work well. The estimated consumption during the year in the different towns in gallons per head was as follows :—Benares 12·21 ; Lucknow 4·5 ; Cawnpore 10·9 ; Agra 8·3 ; Allahabad 9·6 ; Meerut 4 ; Dehra 7·5 ; Mussoorie 6·39, and Naini Tal 11·87. As compared with 1900, all show an increase except Benares and Meerut. In Benares the decrease is small, but in Meerut the consumption of water has fallen from 8 to 4 gallons a head. The reason for this is not clear, but the falling off is in the consumption outside the cantonment, within which the increase was nearly 34 per cent.

The Sanitary Board held five meetings during the year. They considered projects and estimates amounting to £48,300, of which the more important were the following :—

An estimate amounting to £2,310 for the purchase and erection of four new boilers and altering the boiler-house at the Agra water-works was recommended for sanction. An estimate (£160) for extending the Mussoorie water-supply was approved. Plans and estimates (£5,000) for improving the drainage of Farrukhabad, plans and estimates (£1,674) for improving the Ganda Nala, Cawnpore, and plans and estimates (£2,290) for the drainage of Muzaffarnagar were approved.

The Cawnpore drainage and sewerage scheme was discussed, and the estimates for the main and low-level sewers, amounting to £32,540, were recommended for sanction.

The reports of the working of the village Sanitation Act during the year were considered, and the Board noted with satisfaction that the attention paid to improving the sources of water-supply and to general sanitation in the villages to which the Act has been applied was well sustained.

Punjab.—The aggregate income of the municipal towns in the Punjab in 1901, including an opening balance of £73,130, was £387,310, and of this sum rather more than 20 per cent. was spent on sanitation ; on water-supplies £14,156 ; on drainage and sewerage £4,916 ; on conservancy £44,496 ; on the construction of latrines £800 ; and on paving and widening streets £2,818.

The amount derived from the sale of manure in the municipal towns, which had been declining in previous years, rose from £9,521 in 1899 to £10,812 in 1900, but owing to the transfer of certain towns to the North-West Frontier Province there is an apparent decline in 1901 to £10,032, including £2,670 obtained in Amritsar, £943 in Delhi, and £756 in Lahore.

The more important works completed were the following :—

The extension of the Delhi waterworks, comprising an inlet well and pumping station on the bank of the Jumna, with two settling tanks and six filter beds.

The Abbottabad drainage scheme was finished in June, and has worked satisfactorily.

The Fazilka drainage scheme, although completed, was not taken over by the Municipal Committee, because the working was not satisfactory. Proposals for the alteration of the drain at a cost of £267 were submitted to Government.

At Simla, the Saog reservoir and the lower gravitation line were finished, and the extension of the old gravitation line was completed. The sewerage system was extended and an installation for the experimental treatment of sewage was set up.

The following schemes were under consideration or were sanctioned : —

The estimate for the Amritsar water-supply scheme was sanctioned by the Government of India, and work, it was hoped, would be begun when a more suitable site for the supply wells had been approved.

The water-supply scheme for Lyallpur town and civil station and the drainage scheme for the town were sanctioned by the Local Government.

A project for the better drainage of the Simla bazar was prepared.

The extension of the Kalka water-supply and drainage scheme for Rawalpindi, Multan, and Ferozepur were considered.

The Sanitary Board met five times during the year, and the following were the principal subjects considered by them :—

(1) Rules for the guidance of the Board, of the Sanitary Engineer, and of local bodies were drafted and submitted to Government for approval.

(2) A drainage scheme for the town of Chunian was approved and sent to the Commissioner of Lahore for action.

(3) The Umballa extramural drainage project was approved and sent to the Commissioner of Delhi for action.

(4) A drainage scheme for Chiniot Road town was approved.

(5) and (6) The Lyallpur water-supply and drainage schemes were modified and approved.

(7) The Gujarat extramural drainage scheme, prepared by the Sanitary Engineer, was approved, and referred to the local authorities, in order to ascertain if they were prepared to meet the cost.

North-West Frontier Province.—The income of the municipal towns amounted to £43,234, including an opening balance of £10,957 and £1,148 derived from the sale of manure and street sweepings. The following sums aggregating £7,280 were spent on sanitation: on conservancy £4,074; on drainage and sewerage £1,062; on water-supply £1,933; and on the construction and repair of latrines £212.

No new work of capital importance was undertaken, although improvements in the drainage of Abbottabad and Peshawar were carried out. At Abbottabad arrangements are being made to obtain a supply of water from the Kakul wells as the existing supply is insufficient. The extension of the water-supply of Kohat and a scheme for the drainage of Dera Ismail Khan were under consideration.

Central Provinces.—The total income of the district headquarters' municipalities for the year 1900–01, excluding opening balances and certain receipts under special grants, &c., was £70,062, or £1,294 less than in the preceding year. Of the total income 33·29 per cent. was spent on original and recurring sanitary works, against 28·18 per cent. of the income in 1899–1900. The expenditure on new works was very small, both in the towns and in the districts, on account of the heavy expenses that had to be incurred on account of the famine. Considerable improvements were, however, effected in the drainage of some of the larger towns; the storage capacity of the Ambajheri reservoir at Nagpur was increased, and a new filter-bed was constructed near the river pumping-station of the Fraser water-works at Wardha.

The Sanitary Board met four times during the year in the districts of Jubbulpore, Narsinghpur, Hoshangabad and Nimar, and a good deal of work was carried out under their direction, chiefly the construction and repair of wells and the clearing of village sites.

Berar.—The estimated income of the twelve municipal towns in Berar in 1901 was £17,582, or £1,436 less than in 1900. Of the total, 36 per cent., or £6,439, were spent on sanitation, as compared with £8,483 in the preceding year. The sums spent on sanitary works by district boards amounted to £5,142, or £2,052 less than in 1900, the decrease being mainly under the heading water-supply in the districts of Amraoti and Akola.

The Sanitary Board met once at each district headquarters, the matter under consideration being the amount of practical effect given by local bodies to the suggestions of the Sanitary Commissioner recorded in previous years in his survey notes on towns and villages.

Madras.—No details regarding income or expenditure are furnished in the provincial report. The construction of the waterworks' extension and protective works at Trichinopoly, which were commenced in 1900, were still in progress during 1901, the extension to Worriur, one of the suburbs, being the only work of capital importance completed in the Presidency during the year. The Vizagapatam and Coconada water-works, begun in 1900, were also in course of construction, and a scheme for the water-supply of Ootacamund from the Tiger Hill reservoir was being carried out.

District medical and sanitary officers inspected 424 towns and villages, and forwarded copies of their reports to the Sanitary Commissioner and to the local bodies concerned. When the expenditure required on the alterations advised is trivial, it appears that action is generally taken, and in this way valuable improvements in respect of village water-supplies, conservancy, and the sanitation of schools have been effected; but the Sanitary Commissioner recommends that a definite percentage of the available funds should be set aside for expenditure on sanitation.

Progress in sewage farming, sewage filtration, and the employment of town sweepings and night-soil for agricultural purposes continues to be made, and Government sanctioned a series of experiments on the use of sewage filtrates as fertilisers.

During the year the Sanitary Board scrutinized the plans and estimates of 85 sanitary works, of which 38 were for municipalities, 43 for local fund boards, three for the Collector of Madura, and one for the Collector of Salem, the aggregate estimated cost of the projects being £96,000.

The following were among the projects sanctioned by Government on the recommendation of the Board :—

(1) The construction of the Tiger Hill reservoir in connection with the Ootacamund water-supply.

(2) Improvements in the Ootacamund market, £1,337.

(3) Closing the wells at Calicut within fifty yards of the Kannanparamba burial ground.

The following are among the schemes examined and laid before Government :—

(1) The Erode water-supply, Cauvery scheme, £6,867.

(2) Amended water-supply scheme for Kumbakonam, £27,000.

(3) The Ongole water-supply, £8,000.

(4) Sinking artesian wells at Ellore, £1,460

(5) Augmenting the water-supply of Adoni, £1,074.

roposals for many more schemes were received and considered by the Board, but few of them were in a sufficiently advanced state to admit of estimates being prepared.

Coorg.—Particulars regarding the revenue and expenditure on sanitation in the towns and districts of Coorg are not furnished in the report ; but, beyond the construction of a low-level cistern in connection with the waterworks at Mercara and improvement to the surface drainage of the town, no expenditure on sanitation calling for special remark was incurred.

The Sanitary Board met twice during the year, but no business of importance was transacted by them.

Bombay.—Excluding the Presidency town, there were 165 municipalities in Bombay, and their aggregate income in 1900–1901, including opening balances, was £479,894. The amount spent on conservancy, drainage, and water-supply was £95,168, or about 19·83 per cent. of the income. The total income of the 23 district and 207 taluka local boards was £272,325, and the expenditure on water-supply and drainage was £11,566, or about 4·24 per cent. of the income.

It is explained that the presence of plague and famine deterred local bodies from initiating any sanitary scheme of importance.

The number of meetings of the Sanitary Board is not reported, but the following are the principal matters which occupied their attention during the year :—

Kaira.—A project was prepared by the Sanitary Engineer for the supply of water from a well situated about a mile from the town. The estimated cost is £6,554 for the supply and distribution of 100,000 gallons a day.

Mehmedabad.—A somewhat similar water-supply project to cost £5,672 was prepared by the Sanitary Engineer.

Poona.—The drainage and water-supply scheme which was estimated to cost £293,000 was rejected on account of the excessive cost, and a modified partial scheme for drainage to cost £71,810 was prepared and was being considered by the municipality.

Plans and estimates amounting to £3,018 for an experimental sewage farm at Manjri were prepared. Fifteen acres of land were acquired and fenced in, and a septic tank and bacteria beds were constructed.

Ahmednagar.—The Sanitary Engineer checked the plans and estimates amounting to £15,310 for the Nagabhai and Kapurwadi water-supply scheme for the city, and they were sanctioned by Government.

Burma.—The addition in 1901 of Allanmyo to the municipal towns of Burma raised their number to 42. The aggregate income of the year, including opening balances amounting to £121,600, was £440,226, or about £130,000 more than in the preceding year.

The proportion of income devoted to sanitation in 1900 was 55 per cent., and this was reduced in 1901 to 35 per cent., including 13 per cent. on conservancy, 9 per cent. on water-supply, and 6 per cent. on drainage.

It is stated that a number of municipalities have important schemes on hand which they are unable to carry out owing to want of funds, and that the question of rendering assistance from provincial revenues is receiving the attention of the Local Government.

At Rangoon the scheme for constructing a lake reservoir at Thamaing had to be given up owing to the great expense involved in acquiring the necessary land. The Hlawga project, for which a survey was made and an estimate amounting to £260,000 was prepared in 1893–94, was brought forward and sanctioned. The demarcation of the land for the reservoir, which is to hold 13,950 millions of gallons, was begun in December.

At Moulmein the cost of the scheme which provides for an impounding reservoir on the Taungwaing hills, about five miles south-east of the town, was revised and work was begun in December. The scheme provides for a reservoir to hold 648 million gallons, at a height of 45 feet above the town, throughout which the water will be carried in pipes.

At Akyab the preliminary scheme was revised at the request of the municipality, and a partial supply preliminary scheme was submitted for approval.

At Myingyan two complete gravitation schemes were prepared. The first is for the construction of an impounding reservoir to store 464 million gallons, 121 feet above the general level of the town, at Chezi, six miles to the south-east of the town. The second is for a reservoir to hold 486 million gallons, 100 feet above the level of the town, at Kyaukyan, two miles to the east of the town. The adoption of the first scheme has been recommended.

At Minbu a project for water-supply from a well in the bed of the Sabwet *chaung*, about two miles from the town, whence the water will be pumped to a distributing reservoir on a hill half-way to the town, has been proposed.

Well schemes were also proposed for Yamethin and Letpadan.

No particulars of the Sanitary Board's proceedings are given in the provincial report.

General Remarks.

Red Sea Pilgrim Traffic.—In view of the stringent measures of quarantine imposed by the Turkish Government, and the inconvenience likely to be experienced by Indian pilgrims in Arabia, the Government of India warned intending pilgrims that they would be well advised to defer their visit to the Hejaz. Arrangements were, however, made at Karachi and Chittagong for the embarkation of pilgrims from areas uninfected by plague; but persons permanently or temporarily resident in any of the infected places were forbidden to embark. At Karachi and Chittagong observation camps were established, where the pilgrims were detained and their clothing and other effects thoroughly disinfected before embarkation. At these observation camps alone could tickets for the voyage be purchased.

Four vessels left Chittagong carrying 2,210 pilgrims. Among them some cases of small-pox were detected at Aden, where they were landed and isolated; and the vessels, after disinfection, were allowed to go on to Cameran. At Cameran itself five cases of small-pox developed, but the precautions which were taken prevented the spread of the disease. Still, in one of the ships from India several cases of small-pox were found on arrival at Jeddah, but the disease soon disappeared.

At Karachi plague re-appeared early in 1901, so that only two vessels, carrying 669 pilgrims, left that port during the season.

Indian pilgrims to the number of 568 arrived at Jeddah from Suakim, Suez, Aden, and other ports, and about 50 overland through Persia and Arabia.

Except for the occurrence of small-pox the health of the pilgrims from India was good.

At Cameran 18,315 pilgrims of various nationalities underwent quarantine; ten days in the cases of pilgrims from India, the Persian Gulf, and the Arabian Coast, and five days in the cases of pilgrims from Java and the Straits Settlements. The health of the

pilgrims at Cameran is stated to have been excellent, and only 12 died, including five Bengalis, all of whom were old people. The scheme for the re-construction of the camps at Cameran does not appear to have been efficiently carried out, and it is stated that, although much money has been spent, very little has been accomplished. The hospitals in the camps are reported to be very imperfect.

The health of the pilgrims in the Hejaz was very good, and as neither cholera nor plague was reported to be present, the quarantine restrictions imposed upon pilgrims returning to Egypt were very slight.

During 1901 the number of pilgrims who landed in Bombay was 1,290. They were conveyed in many vessels, the largest number in one ship being 437 on the S.S. *Hosseinee* and 297 on S.S. *Assyria*. On three of the vessels bringing returning pilgrims to Bombay single cases of small-pox occurred ; one case was landed at Aden, another at Karachi, and the third at Bombay. Disinfection was carried out at both Aden and Karachi. The baggage of all the 1,290 pilgrims who landed at Bombay was thoroughly disinfected ; such pilgrims as were returning up country were not allowed to enter the town, but were sent straight from the disinfecting sheds to the railway station, and thence by train, at Government expense, to their homes.

Two steamers, the *Akbar* and the *Mahammadi*, arrived at Diamond Harbour on the 7th and 10th of May respectively. The *Akbar* had on board 434 pilgrims, but there had been 16 deaths during the voyage, and three sick had to be admitted to hospital on arrival. The *Mahammadi* had on board 402 pilgrims, all of whom were in good health, but there had been 20 deaths on the voyage. The diseases from which the pilgrims died on the ships were, for the most part, such as are incidental to old age and poverty, and did not include any of the infectious diseases.

It appears that many Indian pilgrims proceed to Hejaz insufficiently provided with money, and when the time comes for their return to India they have to depend upon charity not only for their return passage, but for money to purchase food for them while they are waiting for a steamer. In this connection the British Vice-Consul writes :—

"The Indians are still under the impression that a sum of three hundred rupees is quite sufficient to carry a pilgrim from India to the Hejaz and back, but they are quite mistaken. The old times have changed when everything used to be cheap * * * * and the journey costs now twice the money which used to be sufficient formerly. According to my estimate an Indian pilgrim ought to provide himself with Rs. 500 at least before leaving for the Hejaz."

He also advises Indian pilgrims to deposit about Rs. 80 at the British Vice-Consulate on their arrival at Jeddah to cover the cost of the return journey.

Malaria.—Important contributions to our knowledge of malaria have resulted from the labours of Drs. Stephens and Christophers, missioners sent out by the Royal Society, and of Captain S. P. James, I.M.S., who was deputed by the Government of India to assist them. After visiting various places in India, the Commissioners selected the cantonment of Mian Mir for a series of test experiments. These experiments were begun by Drs. Stephens and Christophers, and on their departure from India were completed by Captain James.

A malarial survey of the cantonment of Mian Mir had been made in the latter part of 1901, when it was found that the reputation of Mian Mir as one of the most malarious cantonments in India was thoroughly well deserved. For this reason, and because of the comparatively small rainfall during the rainy season, Mian Mir was chosen for a series of experiments on a large scale regarding the value of certain measures which may be taken against malaria. Much has been written regarding the value of particular remedies, but it has not been generally realised that there is probably no one infallible remedy, that physical conditions must be taken into consideration, and that what may be an effective remedy in one place may be nearly useless in another.

The principal object of the Royal Society's Commission was the problem of mosquito destruction, and after carefully considering the conditions in Mian Mir, it was thought that this method of prophylaxis would offer the best chance of success. At the same time it was decided not to neglect other measures, such as the careful administration of quinine, or the removal to a safe distance from the barracks of any bazar proved to be a source of infection. The first matter to be considered was how the success of a remedy could be estimated. The general opinion of the inhabitants was obviously too vague a measure, while any estimation of the comparative abundance of adult *anopheles* mosquitoes alone would be too largely dependent upon the skill of an individual observer.

It was decided that the degree of success attained could be best gauged by taking several indications into consideration.

1. The apparent effect upon the number of larvæ.

2. The apparent effect upon the number of adult *anopheles* mosquitoes.

3. The effect upon the amount of malarial disease as determined by (*a*) the hospital admission-rate ; (*b*) the percentage of the men found infected ; and (*c*) the percentage of children under 10 years of age with malarial parasites in their blood (endemic index). This last test, the endemic index, is certainly the one on which the most reliance can be placed.

The cantonment of Mian Mir covers so great an area that it was practically impossible to carry out operations in every part of it at the same time, and it was therefore resolved in the first instance to carry on experiments in the lines of the Royal Field Artillery, situated in the most malarious part of the cantonment. The malarial survey of these lines had shown that there were four chief sources of infection for mosquitoes ; namely, the syce lines of the 51st Field Battery situated within fifty yards of the barracks ; the syce lines of the 54th Field Battery situated within a quarter of a mile of the barracks : the hospital followers' lines within one hundred yards of the barracks ; and the Royal Artillery bazar within a quarter of a mile. The endemic index of those places varied from 30 to 60 per cent.

Six species of *anopheles* mosquitoes were found in the lines and bazar, two of them, *A. Rossii* and *A. Culicifacies*, being exceedingly numerous.

It was found that the chief, if not the only, carrier of malarial infection in Mian Mir is the *A. Culicifacies*, the principal breeding places of which are the irrigation watercourses which pass around and through the lines in all directions. The water in these channels is sheltered and impeded in its flow by grass and weeds growing at the edges, and it was found that if the grass and weeds were removed, so that the water flowed along freely at at the sides as well as in the middle of the channel, the numbers of larvæ were greatly reduced.* It was hoped, therefore, that constant cleaning of the channels for months together would produce a lasting effect upon the number of *anopheles* moquitoes, and the principal operations were directed to this end. It was also proposed to line one of the watercourses with bricks and plaster in order to ascertain the effect of such a measure upon the numbers of larvæ in that watercourse. The puddles that would form during the rains were to be filled in. One or more of the regimental bazars was to be moved to a considerable distance from the lines, and quinine was to be issued prophylactically to the troops.

Operations were begun at the end of March under the direction of Captain James with the help of a hospital assistant. Twenty coolies under a headman of the Canal Department were set to work to clear away the grass and weeds from the irrigation channels, to fill up small bays and backwaters, to deepen the channels in places and in every way to improve the flow of water. By the end of April all the water courses had been treated in this way, and the men were free to recommence operations, going over every part more thoroughly and carefully than before, and smoothing the sides of the channels by plastering them with clay. Such operations were constantly repeated, two men being eventually told off to each watercourse to keep it clear, not only of vegetation at the sides, but of floating leaves which afforded shelter to larvæ.

Great practical difficulties were encountered. Many of the watercourses end in the pool of a Persian-wheel, so that, except for about three hours daily when the wheel is working, the water is stagnant. An attempt was made to deal with such watercourses by thoroughly cleaning and drying them once in every ten days ; but the great cost of doing this, and the fact that, in the hot weather, *anopheles* mosquitoes develop from the egg to the adult in less than ten days, render such a measure impracticable. Some of these watercourses were treated with kerosine oil, and this was temporarily successful, but care is necessary to prevent the oil being drawn up by the Persian-wheel and run on to the fields.

One of the irrigation watercourses, about a half a mile in length, running through the middle of the lines in front of the barracks and hospital, which was an exceedingly abundant source of *anopheles* mosquitoes, was lined with bricks plastered with cement.

---

* Compare a valuable paper, "A Preliminary Report of Observations of the habits of Anopheles," by Lieut.-Colonel R. N. Campbell, M.B., I.M.S., and U. N. Brahmachari, M.B., *Indian Medical Gazette*, January, 1902.

This work was begun in May and completed in July, and has resulted in a great reduction in the numbers of larvæ in the watercourse.

When the rains began the difficulty attending the experiments increased. The surface of the land on which Mian Mir is situated is flat, and though the soil is sandy the subsoil is impervious. The rain which falls between May and October is generally distributed in frequent showers. Every heavy shower floods large patches of land and fills the numerous cuttings, which having no fall can scarcely be called drains, the water dries under the hot sun that follows the dispersal of the rain-clouds, but before the larger collections of water are dried another shower fills them anew. With the first rainfall in May additional men were employed to drain away surface collections of water and to fill up a number of the deeper pools. About 250 pools of various sizes and two large tanks were filled in.

It had been found in October, 1901, that 60 per cent. of the children of the syces in the lines situated within fifty yards of the barracks were infected with malaria. On the 18th of July, 1902, these lines were removed, the syces and their families being accommodated in tents half a mile away from the barracks pending the buildings of new lines.

In the other syce lines and in the lines of the hospital followers the systematic treatment of all children with quinine was carried out. It was found that after the first few doses most of the children took the quinine readily, and that even quite small children suffered no ill effect from a dose of ten grains given on several consecutive days. The natives themselves have appreciated the good results of this treatment as evidenced by the greatly improved health of their children. Another prophylactic measure was the systematic administration of quinine to the troops, which was effectively carried out by means of quinine parades twice a week on consecutive days from the 18th of April.

The operations directed to the destruction of larvæ certainly brought about a reduction in the numbers of adult *anopheles* mosquitoes, but in spite of the checks upon their breeding adult *A. culicifacies* and *A. Rossii* could be readily found in the houses from July to November. The numbers were, however, less in that part of the cantonment in which the operations were carried out than elsewhere. But it is evident that the problem of materially reducing the number of *anopheles* mosquitoes in Mian Mir is a very difficult one, mainly because the majority of the breeding places cannot be permanently done away with, and it seems to be doubtful whether any operations short of this will produce a very marked reduction in the number of mosquitoes.

The removal of the syce lines from a site about 140 yards from an irrigation watercourse to tents pitched three-quarters of a mile away from the nearest watercourse and 600 yards distant from the nearest pool produced very striking results. No *anopheles* mosquitoes were to be found in the tents in September and October. Otherwise, except that they were more exposed to the sun and rain and vicissitudes of temperature, the general conditions of life of the syces and their families were unchanged. The percentage of infected children was reduced from 56·5 in October 1901 to 4 in October, 1902; the number of children with enlarged spleens was reduced from 75 per cent. in April, 1902, to 60 per cent. in October, 1902; and not a single case of fever occurred among the adults throughout the season.

The treatment of the children in the other syce lines was attended with favourable results so far as the children were concerned, and there was said to be a remarkable reduction in the number of cases of malarial fever among their fathers.

The effects on the troops are less easy to gauge. In the first place, the year was an unusually healthy one; in the second, the statistics were deranged by the arrival in the station of a second British infantry regiment in October, and the departure in the end of the same month of both batteries of Royal Artillery to Delhi, men attacked by malarial fever occurring on the line of march being sent back to hospital in Mian Mir; and in the third place, there was much greater care displayed by medical officers in the diagnosis of malarial fever, the tendency being to return doubtful cases under some other heading. Taking all these factors into consideration the results seem to show that the operations were successful in diminishing the incidence of malarial fever.*

---

* Full particulars will be found in a forthcoming number of the *Scientific Memoirs*: a Report of the Anti-Malarial Operations at Mian Mir (1901–3), by Captain S. P. James, I.M.S.

With a view to instructing Assistant Surgeons and others who might not have convenient access to larger works, a brief statement of the results of recent researches into the causation and prevention of malarial fevers was drawn up by Captain James. Nearly five thousand copies were circulated, and after the edition was exhausted there remained a demand for more copies. To meet this a new edition has been prepared and is in the press. The text has been revised, illustrations have been added and the scope of the work has been enlarged so as to make it a convenient introduction to the study of malaria.

Tuberculosis in India.—Increasing attention has in recent years been devoted to the occurrence in India of tubercular diseases, with a result, not unknown in similar cases, that what was generally thought to be rare has been found to be common; and the remark is frequently seen, "the more tubercle is looked for, the more often it is found." The consequence of this is that the belief is becoming prevalent that tubercular diseases are not only of frequent occurrence in India, but that they are rapidly increasing in frequency.

How far this is true it is not possible to say, but granted the greater attention given to the subject and the possibility that implicit reliance ought not to be placed upon the positive result of the microscopical examination of the sputum, it does not appear that the figures obtained from army hospitals and from prisons furnish evidence of any considerable increase of tubercular diseases in the country generally.

In the following statement the admission and death rates per 1,000 of strength among European and native troops and among convicts in Indian prisons are given.

The figures for the years 1891 to 1894, inclusive, are not precisely the same as those given in the statistical tables appended to this report for the following reason :—In 1895 the *post-mortem* records of all cases of pneumonic phthisis were very carefully examined, when it was found that nearly all these cases were associated with the presence of tubercle, and the returns were changed accordingly. Since 1895 no death has been entered in the statistics as due to pneumonic phthisis, unless the medical officer reporting it, after special reference, has reaffirmed his belief that tubercle was not present. Such cases are rare.

For purposes of comparison all cases of pneumonic phthisis which were recorded prior to 1895 have been included as cases of tubercle of the lungs.

Year.	European Troops.		Native Troops.		Jails of India (excluding Andamans).	
	Admission per 1,000.	Deaths per 1,000.	Admission per 1,000.	Deaths per 1,000.	Admission for 1,000.	Deaths for 1,000.
1891	3·7	·55	2·6	·75	4·2	1·98
1892	3·3	·69	2·5	·67	4·5	2·20
1893	3·3	·63	2·1	·59	5·4	2·65
1894	3·5	·46	2·2	·64	5·9	2·91
1895	4·8	·52	2·3	·67	5·8	2·52
1896	5·0	·64	2·5	·65	7·3	2·99
1897	4·2	·56	2·6	·79	7·1	2·80
1898	3·0	·58	3·5	·63	7·9	2·99
1899	3·1	·56	3·3	·68	7·8	3·09
1900	3·4	·58	3·7	·78	8·8	3·76
1901	3·4	·46	4·2	·84	8·6	3·54

Among European troops there has apparently been no increase in recent years in the ratios of admissions and deaths from tubercle of the lungs. The high admission-rates in

1895–97 were due to the prevalence of phthisis among the men of a recently arrived regiment recruited in a mining district. The invaliding statistics do not show any increase either. Exceptionally small numbers were invalided in 1893 and 1899 (·80 and ·75 per 1,000 respectively), but in the other years the millesimal ratios have fluctuated between 1·10 in 1891 and 1·76 in 1896. Among native troops, although the death-rates in the years 1899–1901 are higher than in any other three consecutive years, the rate in 1897 is higher than in any other year of the eleven except 1901. There is, however, a distinct rise in the admission-rates from 1898 onwards.

In this Report for 1899 it was shown that as the ratios of deaths ascribed to anæmia and debility among prisoners fell so the ratios of deaths from tubercle rose. It would appear that there has been a similar change in the regimental hospitals. Between 1891 and 1897 the lowest admission-rate for anæmia was 4·4 per 1,000 in 1895 and in 1896, while the lowest death-rate was ·12 in 1894. In 1897 the admission-rate fell to 3·5 and the death-rate to ·06. The anæmia admission-rates since have all been low, except in 1901, when the rate rose to 4 per 1,000; and the death-rates have remained at ·06, except in 1899, when the rate was only ·04. Early in 1897 the revised Nomenclature of Diseases, in which it is directed that when the cause of anæmia is known the case should be returned under the head of the primary disease, was taken into use; and the increase in the proportion of cases of tubercle of the lung is partially explained by the decrease in the proportion of cases returned as anæmia without special reference to the cause of the condition. The fact that the fall in the ratio of anæmia cases took place before the rise in the ratio of cases of tubercle of the lungs may possibly be explained by the peculiar conditions of 1897, when a large part of the army was on field service.

Among prisoners there was a considerable rise in the admission-rates for tubercle of the lung in 1893, and another in 1898, while the death-rates have gradually risen, and from 1899 inclusive have been over 3 per 1,000. The explanation of the rise of the rates among prisoners is not a simple matter, because so many factors exercise a profound influence on their health. A malarious year, for instance, will greatly add to the number of cases of anæmia. A famine year may be expected to add to the number of cases both of anæmia and tubercle, not alone because the classes from among whom the vast majority of prisoners are drawn are insufficiently fed, but because the increase of crime causes the jails to be overcrowded. Again, while the watchful care of the prisoners' health in many of the central jails could hardly be improved, the statistics receive contributions from small jails in outlying places where the medical skill is not always of the highest order.

The early years of the decennium were very malarious, and cases of anæmia and debility were very common, so that it could not be expected that the growing admission-rates for tubercle of the lung would be exactly balanced by declining admission-rates for anæmia. The years 1897 and 1900 were marked by terrible famines, and the condition of the people and of the jails favoured the development of both anæmia and tubercle. In 1898, however, there was a great fall in the admission-rate for anæmia, and the rates have not again risen.

Although the ratios of deaths ascribed to anæmia have fallen, their fall is not equal to the rise in the ratios of deaths from tubercle of the lungs. If, however, the death-rates from tubercle of the lungs and anæmia are taken together, the increase in the combined death-rates is not marked, and may be explained, at any rate for the most part, by the effects of the famine of 1900. There is, however, another heading under which deaths are returned which must be taken into account—debility and old age; and if the combined death-rates from tubercle of the lungs, anæmia, debility, and old age during the eleven years are compared, it will be found that the death-rates were exceptionally high in 1894 (an unhealthy year) and in 1897 (famine) and 1900 (famine), but no progressive increase is discernible. The tendency, then, has been for the tubercle rates to rise at the expense of the anæmia and debility rates; but as the hygienic condition of many of the jails has been improved, the rates under the latter heading should have fallen irrespective of the greater precision of diagnosis, so that it may be that tubercle has actually increased among the jail population. It certainly is not decreasing, and the death-rate from tubercle of the lungs is higher among Indian prisoners than it is among the English population at any age period.*

* Registrar-General's Report, 1900, page xxx.

The following statement shows the relation of tubercle of the lungs to anæmia and debility in the different jail administrations during 1901 :—

Provinces.	Tubercle of the Lungs.			Anæmia and Debility.		
	Per 1,000 of Strength.		Percentage to total deaths.	Per 1,000 of Strength.		Percentage to total deaths.
	Admissions.	Deaths.		Admissions.	Deaths.	
Andamans	10·8	6·57	17·2	3·9	·08	·2
Burma	9·9	4·31	28·2	4·7	·17	1·1
Assam	2·2	...	...	30·6	3·74	14·3
Bengal	9·4	3·72	13·5	10·0	·40	1·4
United Provinces	8·6	3·68	15·2	22·4	·48	2·0
Punjab	8·7	3·04	11·3	20·6	1·11	4·1
North-West Frontier Province ...	3·2	...	...	13·6	...	...
Bombay	5·6	3·80	10·5	15·5	1·46	4·0
Berar	4·0	2·02	8·1	14·8	2·70	10·8
Central Provinces	5·2	2·50	9·1	31·2	2·29	8·3
Madras	12·3	4·11	17·6	4·8	·29	1·2
Baluchistan—Quetta	...	...	...	...	...	...
Rajputana—Ajmer	...	...	...	40·4	4·26	11·8
Coorg—Mercara	18·3	...	...	73·4	27·52	16·7
India	8·8	3·86	14·4	14·5	·71	2·6
India, excluding Andamans ...	8·6	3·54	13·8	15·8	·78	3·0

It is not yet possible to form any accurate idea of the amount and distribution of tubercular disease among the general population of India, as our registration returns, although they will in future include respiratory diseases, take no account of phthisis. But in the great seaports registration is more advanced, and the following figures compiled from the weekly Port Health reports, when compared with the figures recorded in London, are sufficiently remarkable :—

	Mortality per 1,000.		
	Total.	Excluding Plague.	Phthisis.
London (Registration County), 1900*	18·743	...	1·718
Calcutta, 1901†	37·7	28·4	1·2
Bombay, 1901†	75·5	51·6	8·3

* Registrar-General's Report, 1900, page cviii.
† Excluding one week for which returns not available.

In both towns and particularly in Bombay deaths from plague may be returned as deaths from phthisis, but, even if this is largely the case, the death-rate attributed to phthisis is very high, and it is satisfactory to know that special measures to combat the disease are being taken.

In connection with the Resolutions of the General Meeting of the British Congress on Tuberculosis, the Government of India took the opportunity to suggest to all local governments and administrations that leaflets, containing brief directions for the avoidance of danger to their neighbours, should be given at all public dispensaries and

hospitals to patients suffering from tubercular phthisis ; that suitable action in regard to the inspection of articles of food and drink should be taken in municipal towns ; that arrangements should be gradually made in all jails, where such do not already exist, for the isolation and treatment in the open air of phthisical cases ; and that the special attention of Inspectors under the Indian Factories Act should be drawn to the measures that can be taken under the Act to secure the absence of overcrowding, the provision of good ventilation, and the observance of cleanliness.

Pasteur Institute of India.—Excellent work continues to be done at the Pasteur Institute, Kasauli, under the direction of Major D. Semple, M.D., R.A., M.C. During the year ending 8th August, 1902, 543 persons who had been bitten by rabid animals were treated, as compared with 321 treated during the previous year.

The following tables exhibit the results among Europeans and natives respectively :—

Europeans 215—

Men	164
Women	23
Children	28

Classes.	Sub-class I. Bitten on the Head or Face.			Sub-class II. Bitten through the exposed Skin on any part of the Body other than the Head or Face.			Sub-class III. Bitten through the Clothing.			Totals.		
	Treated.	Failures.	Percentage mortality.	Treated.	Failures.	Percentage mortality.	Treated.	Failures.	Percentage mortality.	Treated.	Failures.	Percentage mortality.
Class A. Bitten by animals proved rabid	9	0	0	63	0	0	14	0	0	86	0	0
Class B. Bitten by animals certified rabid.	2	0	0	43	0	0	7	0	0	52	0	0
Class C. Bitten by animals suspected rabid.	7	0	0	47	0	0	23	0	0	77	0	0
Total	18	0	0	153	0	0	44	0	0	215	0	0

Native 328—

Men	257
Women	19
Children	52

Classes.	Sub-class I. Bitten on the Head or Face.			Sub-class II. Bitten through the exposed Skin on any part of the Body other than the Head or Face.			Sub-class III. Bitten through the Clothing.			Totals.		
	Treated.	Failures.	Percentage mortality.	Treated.	Failures.	Percentage mortality.	Treated.	Failures.	Percentage mortality.	Treated.	Failures.	Percentage mortality.
Class A. Bitten by animals proved rabid	6	0	0	81	3	3·7	5	0	0	92	3	3·26
Class B. Bitten by animals certified rabid.	1	0	0	38	0	0	3	0	0	42	0	0
Class C. Bitten by animals suspected rabid.	15	0	0	155	2	1·29	24	0	0	194	2	1·03
Total	22	0	0	274	5	1·83	32	0	0	328	5	1·52

The tables do not include twenty persons who presented themselves for treatment, but were found not to require it, nor do they include two patients (natives) who developed hydrophobia during the treatment, and four persons (one European and three natives) who were seized with hydrophobia within fifteen days after the last inoculation.

The results of the treatment of Europeans are perfect. The failures among natives are attributed to the following causes :—

1. Natives, owing to their scanty clothing, were generally more severely bitten than Europeans.

2. Many wasted valuable time before going to the institute for treatment.

3. In only a few of the cases had the wounds been cauterised early or efficiently; and in a considerable number of the cases the wounds had been neglected and were suppurating on arrival at the institute.

4. A large number were bitten by jackals.

The greater danger of the jackal's bite is illustrated by the fact that most of the casualties during the year occurred among a batch of 35 persons treated for jackal bites in August, 1901. These cases were treated in the ordinary way, but over 11 per cent. died. Since then, persons bitten by jackals have been treated by a more intensive method than those bitten by dogs, and out of 64 persons bitten by jackals treated in this way not one has died.

Major Semple urges the necessity for the immediate "first aid" treatment of all bites. He considers pure carbolic acid to be the best caustic, because it penetrates into all the crevices of the wound, without causing excessive pain. It should be thoroughly swabbed into the wound and then the wound should be washed with water. Failing carbolic acid, other caustics may be used, or an antiseptic solution or pure water. The object is to remove as much as possible of the poison from the wound and to destroy *in situ* what cannot be removed.

Major Semple deprecates the sucking of the wound, on account of the danger of inoculating the lips or mouth; and excision, on account of the danger of carrying the poison to the larger wound made by the knife. He also warns all persons bitten by rabid dogs of the great danger involved in delaying the commencement of the antirabic treatment.

In addition to the antirabic treatment, much general bacteriological work was carried out at the laboratory in connection with the diagnosis of enteric fever, Malta fever, malarial fever, plague, tubercle, diphtheria, tumours, &c.

Antityphoid vaccine for 4,000 cases was prepared and sent out.

Samples of brain and spinal cord of suspected animals to the number of 106 were tested, and in 80 positive results were obtained.

The preparation of antivenene was commenced, and the serum will soon be ready for issue.

Researches in connection with the improvement of the antirabic treatment especially with a view to dealing successfully with late cases were undertaken.

Investigations into the nature of surra, with the object of obtaining a curative remedy were carried out.

"Anthrax vaccine has been prepared and can now be sent to any part of India when required. The preparation of this vaccine necessitated a prolonged series of experiments in order to obtain cultures of anthrax bacilli of the requisite degree of attenuation. Ponies and sheep inoculated with this vaccine have withstood the subsequent inoculation of virulent anthrax taken direct from the spleen of a horse immediately after death from anthrax."

Lathyrism.—The apparently increasing prevalence among the people of the Central Provinces, chiefly in the districts of Saugor, Damoh, Hoshangabad, Jubbulpore, and Bilaspur, of a form of paralysis believed to be due to eating the seeds of a vetchling (*Lathyrus sativus*) known locally as *teora*, has led to a special enquiry, the conduct of which has been entrusted to Major Andrew Buchanan, I.M.S. It may be expected that this investigation will settle the vexed question of the cause of lathyrism and suggest practicable measures for its prevention.

Cerebro-spinal meningitis.—Among prisoners in Indian jails in 1902 there were 104 deaths ascribed to cerebro-spinal meningitis. Fatal cases occurred in every month of the year except July, the largest numbers of deaths occurring in February and March, 21 and 24 respectively. Cases occurred in six provinces, the Punjab heading the list with

41 (maximum monthly number 12, in May) closely followed by Bombay with 37 (maximum number 14, in March). Ten deaths occurred in the United Provinces, nine in Bengal, five in the Central Provinces and two in Burma. There can be little doubt that the disease was widely spread among the general population of many of the provinces. As the subject was one that called for special investigation an officer was appointed to carry out an enquiry into the etiology of the disease as it occurs in India. Captain Robertson Milne has been selected for this purpose.

Scientific Memoirs.—In 1884 the publication of the Scientific Memoirs by Medical Officers of the Army of India was begun for the purpose of affording a convenient medium for the publication of selected original papers on scientific subjects which it had been the custom to include in this report. Twelve parts of the Scientific Memoirs have been published, the last in 1901. It was found in practice that the publication of such papers at certain intervals presented serious disadvantages ; on the one hand, the supply of suitable contributions was exceedingly irregular, and on the other important papers had to be held over until sufficient matter to fill a volume accumulated.

To obviate those disadvantages it was decided to publish papers separately as soon after their completion as possible ; and the opportunity was taken, while retaining the old name of the series, to enlarge the title so that papers by all officers of the Medical and Sanitary Departments of the Government of India might be included. At the same time the arrangements for the distribution of the numbers of the series were revised, and copies are now very widely distributed, not only in India and in Great Britain, but to most of the universities and to many of the more important scientific libraries throughout the world.

ABSTRACT OF THE REPORT OF THE SANITARY COMMISSIONER FOR MADRAS FOR 1901.

(*Lieutenant-Colonel W. G. King, C.I.E., I.M.S.*)

General Population.

The population of the Presidency, according to the Census of 1901, was 38,623,066. The European and Eurasian population included in this total amounted to 40,231. The "natural increase" since last census amounted to 2,572,646, against 4,879,894 in the former intercensal period. The intercensal rate of increase for the Presidency, excluding feudatory States, was 6·99 per 1,000, but if the districts that had been specially subjected to famine and scarcity during the period be excluded, namely, Kurnool, Cuddapah, Bellary, Ganjám, Gódávari, Kistna, Vizagapatam, Anantapur, Nellore, and North Arcot, the rate of increase has been 7·24 per 1,000. Cooly emigrants during the year exceeded immigrants by 4,849. The population under registration during the year was 37,315,611. In all municipal areas registration of births and deaths was compulsory, and also in 441 against 400 villages in the previous year, under Act III of 1899. Owing to the absence of the enforcement of the Village Proprietary Act, it is still impossible to secure correct statistics from rural areas under zemindars. The method of inspection of registration records stated in former reports continues. At the suggestion of the Government of India, registration in rural areas under the heads "plague" and "respiratory disease" has been required. The forms employed in rural areas are under discussion. In reply to enquiries as to how many District Medical and Sanitary Officers have arranged to carry out my suggestion that Municipal Registrars should be trained in respect to medical terminology, the majority have reported that action has been taken. 87 prosecutions were undertaken by Municipal Councils for failure to comply with legal requirements as to compulsory registration.

Births in Districts.—The total births reported during the year in the whole Presidency were 935,749, against 1,049,199 in the year 1900—a decrease of 113,450. The birth-rate per 1,000, therefore, reckoned upon the population according to the census of 1901 was 25·1, or a decrease of 6·7 per 1,000 when compared with the previous year. This indicates a very heavy fall in fecundity, even were allowance made for factors recognized as tending to the securing of imperfect statistics. One source of error is, however, at once apparent in this calculation. It has already been pointed out by me (and in this I have been supported by the Madras Government) that reckoning upon a census population year by year without allowing for the intercensal rate of increase, permits of an appearance of improvement in registration results that may not exist in fact. But, on the next census figures being available, a sudden drop in this improvement must occur, to be duly resumed in the succeeding years. This would at all times be avoided by use of "estimated populations." This having been forbidden, I at least may appeal to the fact that, if the 1901 births be reckoned upon the 1891 census, as was the case in 1900, the birth rate results are by no means so appalling; the rate then becomes 28·3 per 1,000, and shows, by comparison with 1900, a fall of 3 5 per 1,000. But a fall in the total birth-rate of the Presidency has not been unexpected in that, as shown by Mr. Stuart in the Census Report for 1891, the rate of increase in the intercensal period dealt with by him was abnormal, as a result of the age constitution of the people following the mortality of adults in the 1876–77 famine. This factor must show increasing power for some years to come; but the sudden fall during the year under review cannot be fully thus explained. It cannot be ascribed to laxity in registration at a period when compulsory registration has been advanced in many areas, and the endeavour to secure better registration has been evident throughout the Presidency. Moreover, such an argument would

assume that unusual carelessness has been exhibited in 21 out of 22 districts. I can discover no religious or other reason to believe that marriages were not carried out as usual during the year, or in that preceding it. Hence allowing the factor of changing age constitution of the population full weight, the result must, in great part, be ascribed to the well known physiological influence of high prices of food upon fecundity. In accepting this interpretation it must be remembered that the strain of high prices of food has acted upon certain classes of the population for successive years.

In scrutinizing the birth-rates of the various districts, to secure their just appreciation it would be necessary to compare results, as I have done, in considering the whole population of the Presidency, in the preceding paragraph ; but as this would be inappropriate, it will, I hope, be remembered that the decrease of the birth-rate is not so great as the figures would convey, and that they are of utility only in making comparisons, seeing that the error is common to the whole. Further explanation is necessary as to the rates in the case of Ganjám and Madura. Both these districts include large zemindari tracts. It has not been possible to obtain from the Collectors statistics for these, nor has it been possible, in communication with the Superintendent of the Census, to exclude the populations concerned ; hence, the total births reported from tracts other than zemindari have been applied to the total population—a very weak method of calculation, but the only one feasible. If these two areas be excluded, it is found the more notable diminution of birth-rates, when compared with the preceding year, occurred in Chingleput (13·6), North Arcot (9·8), Madras (9·0), Kistna (8·6) and Kurnool (7·5).*

Deaths in Districts.—Were the decrease of birth-rate explainable on the grounds of mere cessation of marriages, as a result of precaution in view of high prices, the death-rate would show a diminution, by reason of less number of deaths of infants ; but where the impress has been upon the fecundity of a population as a result of high prices of food-grains, an increase of the death-rate may be expected to occur if the strain has been severe, notwithstanding the less infantile rate. It is, however, obvious that whilst this factor was sufficiently powerful to depress the physiological functions, it has not been sufficient to sensibly increase the total mortality. The total deaths during the year were 796,140, or an increase of 25,281 when compared with the previous year. Reckoned upon the census population of 1901, the total death-rate was 21·3 per 1,000. Of the total deaths no less than 81,370 were due to cholera, whilst only 3,226 in excess of the number of the previous year were due to "diarrhœa and dysentery"—the diseases *par excellence* attending privation. Under all other heads of registration except plague (3,035 cases) there was a diminution of mortality. The total death-rate of infants below one year of age was 166·2 per 1,000 of the registered births, against 164·9 per 1,000 in the previous year. The death-rate of male infants was 174·6, against 157·5 per 1,000 of females. In no district except the Nilgiris did the mortality of female infants exceed that of males. In the case of Malabar, the total registered infantile death-rate was 98·9 per 1,000 of births. This is in complete contrast with results in other districts of the Presidency, and must be ascribed to failure to register deaths of infants, and to the long established custom of that area of burying infants within private premises. The necessity for care in the registration of births and deaths of infants was particularly urged by me upon all authorities responsible, in June 1899. Having regard to the scattered condition of houses in villages in Malabar, however, better results can be expected only as a consequence of steady insistence through a series of years.

Births in Municipalities.—The population under municipal administration amounts to 2,406,455, according to the Census of 1901. The total births (78,554) yield a birth-rate of 32·6 per 1,000, against 38·5 per 1,000 in 1900. Reckoned upon the census population of 1891, the rate was 36·2. There was a decrease of 4,490 in total births registered in municipalities when compared with the total of the previous year ; this occurred in 44 towns of a total of 61. That the town population of the Presidency should have been less influenced than the rural as to fecundity by the high price of food-grains, seems to support the view that the pressure was chiefly upon the lowest classes of the agricultural population. The most marked decrease occurred in the following towns: Vellore, Trichinopoly, Kurnool, Conjeeveram, Calicut, Masulipatam, Madras.

Deaths in Municipalities.—The total deaths registered was 85,266, representing a death-rate of 35·4 per 1,000. The death-rate was considerably above normal in Bellary

* Unless otherwise stated throughout this Report, figures enclosed in brackets refer to rates per 1,000.

(48·1), chiefly due to cholera and plague; in Chingleput (38·4), where owing to the smallness of the population the deaths from fever have made an increase more apparent than real; in Berhampur (40·5), chiefly under fevers and cholera. In Madras the exceedingly heavy rate of 55·5 per 1,000 occurred. This, however, represented but an increase of 14·6 upon the quinquennial average, and was due to death registration under cholera and fevers.

The total average infantile mortality in municipalities was 237·3 per 1,000 of births. This represents an increase of 14 per 1,000 when compared with last year, and may possibly reflect the influence of the continued strain of prices already discussed, in addition to the usual factors of insanitary environment, and ignorance of hygienic care of infants characteristic of the uneducated Hindu mother. The rate may be contrasted with that obtained under the very unfavourable conditions of town life in England. There the total average of 55 towns yields a rate of 182, and in London 166 per 1,000. In the following towns, the rate of infantile mortality was particularly heavy:—Berhampur (273.6), Bezwada (277·4), Madras (328·4), Vániyambádi (293·6), Palamcottah (240·4), and Tuticorin (304·4). Lest, however, an exaggerated idea of these undesirable rates be entertained, it may be stated that in at least three towns in England they are exceeded. As in the case of rates referred to in the paragraph above on deaths in districts, which include data derived from rural areas, the mortality of male infants in municipal towns was greater than that of females—the rate being 227·6 for the latter, against 246·6 per 1,000 for the former. That male infants should more readily succumb to unfavourable circumstances in the first year of life, accords with experience in all countries. Normally, births of boys are greater than of girls—for example, for the whole Presidency during the year under review, 100 girls were born for every 104·2 boys; but, by the end of the first year of life, the proportion becomes more equal, as the boys die at a greater rate in the earlier months than the girls. The native tendency is to regard the addition of a male infant to the family as of considerably more moment than of a female. Nevertheless, in this Presidency, this feeling is by no means so marked as to lead to neglect of female infants. The utmost that may occur in this direction is that, in times of marked scarcity, the female may occupy an inferior place in the table of precedence as to choice of supplies.

In former years the mortality of infants from small-pox was regarded by the native population as inevitable. Under the influence of compulsory vaccination, however, the saving of infantile life is becoming yearly more evident. Up to 1894, in certain municipalities compulsory vaccination was optional, subsequent to that date it has been adopted in all municipalities. Since 1900 it has been advanced, on the *festina lente* principle, in rural areas. With the bulk of the rural population vaccination, however, is still optional. If the conditions of 1891 and 1901 be contrasted, it is found that, in 1891, the death-rate from small-pox of infants under one year of age in municipalities was 8 per 1,000 of births, against 7·3 per 1,000 of births in rural areas; whereas, in 1901, the deaths in municipal areas of infants under one year of age from this disease amounted to 2·7 per 1,000, against 8·6 per 1,000 in rural areas. It is thus evident whilst in rural areas, in the years contrasted, the rate of mortality of infants from this cause had not decreased, in municipal areas there was a marked improvement as a result of better vaccination. It need not be said that were the infants liable to vaccination earlier than at six months of age, much more favourable results might be expected. In the hope of securing that guardians of infants born in a rural area under compulsory vaccination shall not evade the provisions of the law by proceeding to a municipality, or *vice versâ*, I have advised Government to secure special legislation. By this means a better grade of protection of infant life can be secured.

Chief Diseases.

Cholera.—There were 81,370 deaths from this disease during the year, or a total of 2·2 of the whole population. Anantapur (4·5), Cuddapah (4·2), North Arcot (4·1) and Salem (5·1) were the districts which chiefly suffered. The municipal towns of Chingleput, Coimbatore, Erode, Karúr, Berhampur, Nandyal, Palni, Calicut, Cochin, Gudiyáttam, Salem, Vániyambádi, Tirupattúr and Mangalore gave rates above 5 per 1,000 from this disease. As to prevention, it cannot be said that either Local Fund, Municipal or Revenue authorities are yet alive to the necessity of taking action during the advance of cholera. In spite of appeals from this office, they take advantage of the discretion allowed them in the rulings on the subject issued by Government, and do not think of appointing staffs until cholera is in their midst, and even then (in the interests of so-called economy) they

allow these to be incomplete. So long as this condition continues no real stand against cholera can be made.

Of the total of 6,822 deaths from this cause in 61 municipal towns, no less than 1,161 occurred in Madras town, or 2·4 per 1,000 of its population. Notwithstanding the expenditure of several lakhs of rupees upon its public water-supply, the Madras Municipal Commission is content to allow the inhabitants to supplement it by the use of innumerable wells that are open to pollution, and are sunk in a foul subsoil. Under the circumstances, the town must be regarded as having escaped well out of evil conditions. The day that its long open water channel becomes contaminated with cholera or typhoid matter will, however, be one not so readily reckoned with. The towns of Coimbatore, Erode, Chingleput, Karúr, Berhampur, Cochin, Gudiyáttam, Vániyambádi, Palamcottah and Tuticorin—all of which have water-supplies readily open to fæcal pollution—chiefly suffered in mufassal areas.

Small-pox.—The total deaths from small-pox amounted to 26,202, against 27,692 of the previous year. The rate of incidence in municipal towns where compulsory vaccination is in force was ·6 per 1,000, against ·7 per 1,000 in rural tracts, in a few unions only of which compulsion is exercised. If the town of Cochin be eliminated, where no fewer than 313 deaths occurred from this disease, the incidence on the total municipal population was 0·5 per 1,000. The large mortality in Cochin was doubtless due to the fact that it adjoins an area under independent native administration, where more care is requisite as to small-pox. Of 2,750 children personally inspected by District Medical and Sanitary Officers during their periodical sanitary inspection of schools, 449 or 16·3 per cent. were found unprotected by vaccination. But of these no less than 70·2 per cent. had undergone small-pox. Of the 2,301 children below and above 10 years of age, who had been vaccinated, the rate of attack by small-pox was ·5 per cent.

Plague.—During the year, there was, in the whole Presidency, a total of 3,960 attacks of plague, with a mortality of 76·6 per cent. There were 1,496 cases in municipalities, of which 702 and 769 occurred in Bellary and Vániyambádi respectively. The town of Bellary was infected by cases imported from the Bombay Presidency, and concealed by house-holders. In all other parts, infection was derived directly or indirectly from the Mysore Territory, which continued to be a source of peril to this Presidency. Disregarding importation from that area by other routes, no less than 120 cases of plague were removed from the trains at the Inspection Station of Jalarpet.

The passport system was extended for purposes of surveillance to contacts. Brushes were used universally for the distribution of disinfecting solutions (which method seems to me erroneous except where smooth or greasy walls are concerned), whilst the sheet anchor of compulsory evacuation (when indigenous plague becomes uncontrollable) was not employed. The passport system gave satisfactory results, and granting there is no reason to doubt that the chances are always that a single neglected imported case may cause an epidemic, numerous localities have been saved from the incidence of plague by prompt discovery of such cases.

Fevers.—294,854 persons died from diseases which are registered under this head; these doubtless are chiefly malarial. Every effort has been made to induce local bodies to turn to advantage the modern dictum as to the rôle of the mosquito in the prevalence of malarial fevers. Some of them have treated the matter with extreme apathy, others have promised to make the desired efforts, whilst others have assigned as their reason their inability to discover that any action is requisite as no malarious spot exists within their control, notwithstanding the fevers shown in their mortality statistics. The District Board of Kurnool has placed at my disposal the sum of £33 towards an experiment to exterminate malaria in a village. This sum is probably below requirements, but it at least exhibits on the part of the district board a wish to make advance in the interests of the inhabitants of a notoriously malarious district. In the matter of distinguishing the various diseases now registered under fevers, little advance can be made until a correct system of registration can be afforded by the country. A diagnosis of typhoid fever is common enough on the Nilgiris and at times in Malabar and South Canara, but is rare in the plains, although I have personally seen cases, from time to time, amongst pure natives in the Trichinopoly and Kernool districts. Mr. Lafrenais, Acting District Medical and Sanitary Officer, Nellore, however, has recently reported to me several cases of typhoid fever in Nellore. The chief supply of this town is a tank that (although I understand improvement has lately been evident) I have on more than one occasion represented to the municipal council was contaminated with fæcal matter to an extraordinary extent.

I will shortly investigate some of these cases by Widal's test. Lieut-Colonel Wilkins, District Medical and Sanitary Officer, Malabar, has sent me a list of 73 cases treated in the various hospitals in his charge during the last ten years. He has also supplied an interesting note, which affords conclusive clinical evidence of the nature of the disease. After quoting similar evidence in his experience in Madras City, he states: "I have kept a careful watch to see whether it was really typhoid or true remittent fever prevailing in this district. For the past six years, I have seen several cases both in hospital and private practice, and I am convinced that the disease prevalent in this district among natives is typhoid. The disease is mostly prevalent about the end of July, the whole of August and September, and then gradually becomes less towards October and November. In other words, it begins with the rise of the subsoil water, is most prevalent at the time the water is almost on a level or within a few feet of the surrounding soil and gradually becomes less as the water subsides. In many cases, if the younger members have escaped one year, the next or perhaps the second year another resident in the house is attacked and this one can easily understand when one knows that all the excreta from a typhoid patient are simply thrown away in most cases near the well, where the bed pan is washed or a plantain leaf, which is used in its stead, is disposed of. It is quite possible that the germs of the disease soak into the soil and as the subsoil water rises, are carried into the wells from which the drinking water is obtained and then the infection passes to those who at the time are predisposed to the disease."

Dysentery and diarrhœa.—In contrasting municipal towns with rural areas, the difference in extent of mortality from dysentery and diarrhœa is marked. For the whole Presidency the rate is 1·1 per 1,000, whereas for the municipal towns it amounts to 5·0. Such a result but illustrates the effect of the aggregation of human beings upon filthy and sewage sodden soils, *plus* water supplies open to contamination. In the following towns the rate was particularly heavy:—Chingleput (9·4), Madras (9·7), Periyakulam (8·0), Gudiyáttam (9·2), Palamcottah (15·5) and Tuticorin (10·1).

Injuries.—The total number of deaths due to injuries was 12,872, or at the rate of 0·3 per 1,000. There were 1,672 suicides, which yield a rate of 0·04 on the whole population. As usual in native life in this Presidency, the proportion of females who committed suicide was much greater than amongst males, namely, for every 100 females 80·0 males; whereas, in Great Britain, it is about 100 females to every 312·8 males. The total deaths from snake-bite and wild beasts amounted to 2,022.

All other causes.—Having regard to the existing system of registration, necessarily, a large number of cases cannot be classified. The result is that no less than 42·2 per cent. of the total mortality is placed under this head.

Sanitary Works.

Municipalities.—In my report for 1899, I called attention to the fact that, whilst on the basis of the statistics available, it would be out of the question to be dogmatic on the subject, there was reason to hold that with the introduction of public water supplies into towns—replacing, in great part, old supplies of shallow wells and tanks—there was evident a fall in the fever rate. I ascertained that, about the same period, Major Rogers, Professor of Pathology, Calcutta, had also pointed out, as a result of careful investigation throughout an extensive malarious area, that he had found where the inhabitants were supplied with filtered water the incidence was less than where unfiltered water was employed. To dare assert that the current literature rôle of the mosquito does not cover the *whole* question of epidemiology of malaria in the present day, is to proclaim oneself decidedly heterodox. To prevent this charge being hurled at me, I may, therefore, state I accept fully the truth that has been proved "up to the hilt" that malaria is conveyable by the mosquito. As I understand it, Major Rogers also entertains no heterodox views. There are, however, blanks in the history of the epidemiology of malaria that demand attention, and this cannot be secured if all matters—involving the mosquito or not—be not placed on record. Statistics in this Presidency show that the more perfectly water-supply has been extended to a town the less is the fever rate notwithstanding that, in the absence of drainage systems, it is exceedingly likely that "anopheles pools" have been much increased. Where the inhabitants by choice use largely the old water-supplies —such as in Madras City—and where the amount is so insufficient as to cause the people to still use them *nolens volens* unsatisfactory results occur as seen in Madura and

Dindigul where no improvement of rate has been obtained. It may, at once, be objected that the improvement in the fever rate is probably not in regard to malarial fever but in respect to typhoid—a water-borne disease. This may be so ; I am not in a position to say much against such a theory, beyond that whilst typhoid probably exists in South India much more than has hitherto been stated, its prevalence is not likely to be so great as to account for the difference. I am content to place the facts on record ; they will form a basis for further enquiry. To secure some (admittedly rough) method of ascertaining the value of these figures, I have excluded, for reasons stated, the three towns above mentioned and have compiled total averages for the six towns concerned, and for seventeen other towns of about the same average population that have *not* had water-supplies introduced up to date—so as to ascertain whether errors in registration, or a "wave" of malaria prevalence, in certain years, have had anything to do with the matter.

It is found that in the six towns (aggregate population 280,979) the average fever death-rate for five years prior to introduction of water-supplies was 8·9 per 1,000, but that, subsequent to introduction, it was reduced to 5·4 per 1,000 ; whilst the total death-rates in the same period were 30·4 and 26·1 per 1,000, respectively—implying in a decade a saving of over 12,000 lives. In the group still unprovided with water-supplies (aggregate population, 754,034), the quinquennial period ending 1896 gave a fever death-rate of 6·3 and the following quinquennium 6·0 per 1,000 ; whilst the total death-rates for the respective periods were 26·8 and 28·2 per 1,000. The increased total death-rates shown in the second group of towns is probably really due to improved registration and not to actual greater mortality—a factor which being common to both groups is of importance. It is noteworthy that in Coonoor where a sewerage system has been completed, the fever rate has declined ; whereas no influence is noticeable in Kumbakónam which possesses a system for relief of surface and, partly, of subsoil water.

It is, unfortunately, not probable that much advance in large sanitary works, such as those for water-supply and sewerage, will be recorded in future Sanitary Reports of this Presidency, having regard to a recent ruling by the Government of India that grants-in-aid will not be given to local bodies. It goes without saying that the financial position of the majority of municipalities is such as to preclude the possibility of their successfully attempting to meet the full charges, without aid from Government. Indeed, although much experience has not been gathered on the point, it would seem that even were municipalities willing to attempt to secure loans in the market for the full cost of works, there chances of success would be extremely doubtful. As an instance, I may point to the case of Tanjore, where a sanitarily good and financially profitable scheme for utilizing sewage has been in abeyance for several years, because it cannot secure a loan of £2,200 in the open market.

During the year, no sanitary works of any importance were completed, except the extension of the water-supply of Trichinopoly to one of its suburbs—Worriur. The progress in sewage farming, sewage filtration, and the employment of town rubbish and night-soil, and sewage filtrates for cultivation purposes continues. The Government of Madras has sanctioned a series of experiments on the latter subject.

District Boards.—District Medical and Sanitary Officers inspected 424 towns and villages, and forwarded copies of their reports to this office and to local bodies concerned. Extracts from these were sent to Presidents of District Boards and Municipal Chairmen, and special enquiries were made as to action taken in numerous instances. Where expenditure involved is of a trivial nature, action has usually been taken and, on the whole, much useful improvement has thereby resulted in regard to rural water supplies, conservancy, and the sanitation of schools. As, however, explained in former reports, so long as the small funds available are frittered away by petty allotments under Taluk Boards and Unions, no solid improvements under District Boards can be expected. Having regard to the fact that 50 per cent. of the total funds available under District Boards must be spent on roads, very little money falls to the share of sanitation—efforts as to which can always be conveniently postponed to that happy period "when funds are available." It is time that a definite percentage of available funds be given for current sanitary expenditure.

The maintenance of Village Sanitary Inspection Books has been satisfactory during the year.

ABSTRACT OF THE REPORT OF THE SANITARY COMMISSIONER FOR BOMBAY FOR 1901.

(*Lieutenant-Colonel J. W. Clarkson, I.M.S.*)

General Population.

European and Eurasian Vital Statistics.

The European Census population of 1901 in the Bombay Presidency, exclusive of Cantonments in quasi-foreign territory, is 18,804. During the year 1901, 217 births and 251 deaths were recorded against 260 and 373 in 1900. A birth-rate of 11·54 per 1,000 against 14·06 in 1900 and a death-rate of 13·35 against 20·17. By sexes 120 males and 97 females were born against 150 and 110 in 1900, and as regards deaths 162 males and 89 females died against 222 and 151 in 1900. The very low birth-rate among Europeans is due to the excessive proportion of the male element in that population.

The Eurasian Census population of 1901 is 6,557. During the year 1901 the births registered were 133 against 149 in 1900 and deaths 180 against 247, the rates being 22·84 per 1,000 against 17·49 in 1900 and 27·45 against 28·99. Of those born, 66 were males and 67 females against 79 and 70 in 1900; as regards deaths, 95 males and 85 females died against 125 and 122 in 1900.

Native Population—Vital Statistics.

Births.—In the Presidency of Bombay, including Sind, during the year 1901, there were 465,647 births registered against 505,662 in 1900. The recorded births for the year under report were less by 40,015 than the number registered in the previous year, and also less by 177,067 than the decennial mean ending 1900. In only eight districts, Khándesh, Ahmednagar, Sholápur, Ratnágiri, Bijápur, Sukkur, Lárkhána, Upper Sind Frontier, did the number of births exceed the deaths. The recorded birth-rate for the year was 25·19 per 1,000 the lowest for the past ten years, against 26·87 in 1900 and a decennial mean of 34·15, a result probably due to weakness induced by famine. The number of births recorded during the year is less in every collectorate than in the previous year except Khándesh, City of Bombay, Ahmednagar, Broach, Kaira and the Upper Sind Frontier.

The Deputy Sanitary Commissioner, Sind Registration District, attributes the low birth-rate recorded in Thar and Párkar district as probably due to the exodus caused by scarcity.

There were 242,382 male and 223,265 female births recorded during the year against 262,837 and 242,825 in 1900. For every 100 female births 108·56 male births were recorded during the year.

The following statement shows the number of births recorded in each year since 1891 :—

Year.	Number of Births.	Year.	Number of Births.	Year.	Number of Births.
1891	682,677	1895	674,304	1899	685,348
1892	650,667	1896	691,847	1900	505,662
1893	664,305	1897	629,693	1901	465,647
1894	660,268	1898	582,371		

It is of interest to note that the effect of famine on the birth-rate began to show itself in April 1900, reached its climax in March 1901, and passed off in December 1901, when the birth-rate again reached the mean of the previous ten years.

The recorded birth-rates among the urban and rural populations of the Presidency were 22·72 and 25·57 against 23·72 and 27·30 in 1900. Except in the collectorates of Thána, Ratnágiri, Surat, Kaira, Panch Maháls, and throughout Sind the birth-rates were higher among the rural than the urban population. The difference is very marked in the Poona Collectorate where the rural birth-rate is 29·63 against 11·70 among the urban. Plague had doubtless a certain effect in producing this result, as many families were sent away and the very severe outbreak of 1900, when 4,325 deaths occurred, would show its effect on the birth-rate of 1901 ; but the chief cause is defective registration, no prosecution being instituted under the existing bye-laws. Defaulters may be discovered, but at present it appears to be no one's duty to prosecute.

Out of 56 towns and seven cantonments in the Presidency, one had a birth-rate exceeding 40 per 1,000. Poona, Gogho, Karád, Panvel, Sátára, Bombay, Bulsár, Belgaum, Alibág, Ahmedabad and Kalyán Towns, and Ahmedabad, Deoláli and Ahmednagar Cantonments have very low birth-rates.

Deaths.—Among the Native population in the rural town and cantonment circles in the Presidency, 686,134 deaths were registered during the year 1901. In 1900, 1,318,783 deaths, or 632,649 more than in 1901, were recorded.

The following statement shows the number of deaths recorded in each year since 1891 :—

Year.	Number of Deaths.	Year.	Number of Deaths.	Year.	Number of Deaths.
1891	513,132	1895	538,540	1899	672,269
1892	611,742	1896	596,472	1900	1,318,782
1893	511,831	1897	749,916	1901	686,134
1894	607,179	1898	548,825		

Of the total deaths registered, 357,586 occurred among the males and 328,548 among females against 706,275 and 612,508, respectively, in 1900. The death-rate per 1,000 in 1901 was 37·12 against 70·07 in 1900 and a decennial mean of 35·43.

The millesimal rate of males dying to males living was 37·52 and of females dying to females living was 36·70. In 1900 these ratios were, respectively, 72·53 and 67·43. For every 100 females who died, 108·84 deaths among males were recorded, but these proportions vary considerably, as in Bombay City the ratio of males to females deaths was 147·87, in Karáchi 134·95 and Násik 110·71.

In the Western, Central, Southern, Gujarát and Sind Registration Districts the number of deaths recorded in 1901 were 164,469, 147,526, 187,058, 120,998 and 66,083 and their ratios per 1,000 37·18, 30·53, 56·77, 44·79 and 20·61, respectively. The highest death-rate occurred in the Southern Registration District, which suffered from plague and cholera, and also famine. In the other districts the death-rate was below the decennial mean.

In the year 1901 the recorded death-rates per 1,000 of population which ranged from 77·78 in the City of Bombay to 13·21 in the Upper Sind Frontier were lower than in 1900 in all the collectorates except Sátára, Belgaum, Dhárwár and Kánara.

The Deputy Sanitary Commissioner, Southern Registration District, remarks that the high death-rates in the Belgaum and Dhárwár Collectorates were chiefly due to plague.

Comparing the birth and death-rates in each collectorate for 1901, the birth-rate in the City of Bombay was much below the registered death-rate 17·48 and 77·78, respectively : this may be ascribed to plague on the one hand and defective registration on the other. In the following collectorates the recorded birth-rates are lower than the registered death-rates :—Thána, Poona, Sátára, Belgaum, Dhárwár, Broach, Ahmedabad and Thar and Párkar.

Deaths by ages.—As regards deaths by ages, the figures show that the ratio per 1,000 of population the largest number of deaths took place in the period "under five years" and the next in the age period "20 years and under 40" the lowest ratio being in the period "15 years and under 20" of the percentage.

The number of male births during the year was 212,082 while the male deaths under one year were 48,022 or 198·12 per 1,000. Among females the numbers were 223,265 and 42,260, respectively, the ratio being 189·28 per 1,000. In England in 1899 the proportion of deaths of infants under one year of age to registered births was 163 per 1,000, the death-rate for the whole population being in that year 18·3 per 1,000.

As the general death-rate in the Bombay Presidency was 37·12 per 1000 in 1901, it will be seen that infantile mortality is not relatively high in this country. Bombay City, however, compares very unfavourably with the rest of the Presidency, as it gives a male infantile mortality of 571·39 on the births, the female ratio being 589·80. ' A point to be noted being that the female ratio is higher than the male.

Deaths by causes.—The subjoined table shows the deaths in 1901 arranged according to the specified causes laid down by the Government of India, and contrasted with the results for 1900 and with the mean of the preceding five years. The "causes of deaths" will be briefly noticed in the next section :—

Causes of deaths.	Mean for 5 years, 1896–1900.		1900.		1901.	
	Number.	Ratio per 1,000 of population.	Number.	Ratio per 1,000 of population.	Number.	Ratio per 1,000 of population.
Cholera	53,870	2·86	163,889	8·71	13,600	·74
Small-pox	4,788	·25	9,885	·52	5,340	·29
Plague	53,003	2.82	33,196	1·76	128,259	6·94
Fevers	360,775	19·17	543,319	28·87	291,951	15·80
Dysentery and diarrhœa ...	94,356	5.01	218,243	11·59	60,198	3·26
Injuries	7,091	·38	8,224	·44	7,092	·38
Other causes	203,370	10·81	342,027	18·17	179,694	9·72
All causes	777,253	41·30	1,318,783	70·07	686,134	37·12

The greatest number of deaths (73,187) took place in October and the least (37,335) in June. In 1900 the greatest and least numbers occurred in July (162,555) and December (66,250).

The recorded death-rates among the urban and rural population of the Presidency were respectively 57·85 and 34·01 per 1,000 of population against 102·33 and 65·57 in 1900. Among the rural population the death-rate was higher than in the urban population in the collectorates of Belgaum, Kánara, Surat and Ratnágiri.

Chief Diseases.

Cholera.—In the year 1901, there were 13,600 deaths recorded as due to cholera contrasted with 163,889 deaths from the same cause in 1900. The disease was somewhat severe in the districts of Dhárwár, Belgaum, and Bijápur, where 7,648 or 6·87, 2,851 or 2·87, and 1,431 or 1·95 deaths per 1,000 of population took place, respectively. In Kánara 657 deaths occurred and in Sholápur 524. In Bombay City a few deaths took place every month, giving a total of 197 for the year. The collectorates of Khándesh and Thána gave eight deaths each, Násik 12, Ahmednagar 75, Poona 38, Sátára 50, Kolába 100, and Ratnágiri three. Sind was entirely free and practically also Gujárat, only one death being reported from Ahmedabad.

In December, 1900, cholera deaths were reported from the districts of Poona, Ratnágiri, Belgaum, Dhárwar, Bijápur, Kánara, Karáchi, Hyderabad, and Bombay City. In January of the year under report, the disease continued in five of these districts—Belgaum, Dhárwár, Bijápur, Kánara, and Bombay City, and there were 1,086 deaths reported. In the month of February the same collectorates, except Bijápur, returned deaths, Ratnágiri being affected in addition. In March the mortality rose to 2,763 deaths, and reached its maximum in April in which month 3,016 deaths were recorded. From May the mortality declined month by month till July when the collectorates of Násik, Thána, Kolába, Poona, and Sholápur were affected in addition. There was a slight increase in the number of deaths in August. From September the mortality rapidly fell, but the disease continued to the end of the year, causing nine deaths in the City of Bombay in the month of December, all other collectorates being free.

By seasons.—The greatest number of cholera deaths, 5319, occurred in the cold season of 121 days, against 6,870 during the same period in 1900; whilst in 1900 the greatest number, 106,193, took place in the rainy season of 122 days, during the year under report the number was only 3,371; 4,682 deaths were recorded in the hot and dry season of 61 days, against 4,805 in the same season last year. In the hot and damp season of 61 days (October and November), 228 deaths were recorded, against 2,811 during the same season of 1900.

Fifteen collectorates were affected by cholera, in 11 of these the death-rate per 1,000 was below one. In the remaining four, Dhárwár recorded a death-rate of 6·87 the highest more than three times the quinquennial mean 1·90, followed by Belgaum with 2·87; in Bijápur and Kánara it was 1·95 and 1·44, respectively.

Out of 220 rural circles or tálukas, 65 were affected by cholera during the year, against 201 in the previous year. The disease principally prevailed in 13 of these and gave a ratio of above 4 per 1,000 of population. The tálukas of Hángal and Bankápur in the district of Dhárwár suffered somewhat severely and gave out 1,208 and 1,396 deaths, or a ratio of 15·53 and 15·45 per 1,000 of population, respectively.

Out of 56 town circles in the Presidency, 18 were affected by cholera, and in most of these the epidemic was chiefly confined to the head-quarter stations of the affected districts. The largest number of deaths, 197, was recorded in the City of Bombay, but the highest ratio, 15·76 per 1,000 of population, took place in Kaládagi in the district of Bijápur.

The affected area included 916 out of 25,846 villages in the Presidency, against 8,461 in 1900. The highest percentage took place in the collectorate of Dhárwár, 467 or 35·98 per cent. of villages were affected. In Belgaum, Bijápur, Sholápur, and Kánara, the percentages were 18·17, 10·12, 4·89, and 4·35, respectively, and in the remaining collectorates the percentages were below one per cent.

Small-pox.—There were 5,340 deaths from small-pox (2,808 males and 2,532 females), against 9,885 in 1900, and a decennial mean of 3,724. The mortality, although less than that of 1900, was higher than that of the year 1897-98 and 1899, and also of the mean for 10 years ending 1900. Only two collectorates, Kánara and Ahmedabad, were free from the disease. The Southern Registration District records the highest mortality—2,686, next in order comes Central with 947, Western with 797, Sind with 786, and Gujarát with 124. In the year under report, 21·82 per cent. of deaths occurred amongst infants under one year of age, whilst 46·68 per cent. took place among children one to 10 years, the remaining 31·50 being among persons over 10 years of age.

Fever.—There were 291,951 deaths registered under the heading fever (152,285 males and 139,666 females), against 543,319 in 1900; thus there was a decrease of 251,368 deaths as compared with the previous year; the decennial mean is 405,494 which includes the deaths from plague for the past five years. The death-rate was 15·80 per 1000 as compared with 28·87 for the previous year and a decennial mean of 12·55, and this includes the deaths from plague during the years from 1896 to 1900. Like the year previous, the Gujarát Registration District recorded a high death-rate, but much lower than that of 1900, which gave an exceptionally high rate. The mortality for the district was 78,628, next comes Western with 62,403, Central with 60,556, Sind with 54,553, and Southern with 35,811.

In the collectorates of Ahmedabad, Broach, Kaira, Panch Maháls, and Thar and Párkar high ratios are observed; this result is due apparently to famine causes to a great extent.

The number of deaths in each month during the year was lower than in the corresponding month of the previous year. The lowest mortality—15,676—was reported in July and it gradually rose till November, when 28,835 deaths were recorded, and 28,438 in December.

Plague.—During the year under report 128,259 deaths were recorded from plague—an increase of 95,063 deaths as compared with the previous year.

The number of deaths ascribed to plague in each year since 1896 is as follows :—

Year.	Number of deaths from Plague.	Year.	Number of deaths from Plague.	Year.	Number of deaths from Plague.
1896	2,086	1898	86,191	1900	33,196
1897	46,944	1899	96,596	1901	128,259

The mortality from this disease during the year was the highest recorded since its first appearance in 1896. All the collectorates in the Presidency, except Thar and Párkar, Lárkhána, and Upper Sind Frontier were affected.

The collectorates most affected were those of Belgaum, Dhárwár, Sátára, and the City of Bombay, with a death-rate of 34·07, 28·65, 19·26, and 24·58 per 1,000 of population, respectively. Karáchi came next with a rate of 7·0, and then followed Broach, Surat, Poona, and Thána with rates which ranged between four and five. The collectorate of Khándesh, in which eight deaths were reported during the previous year, returned 2,676 deaths, followed by Kolába with 1,116 against 140 deaths during 1900. The district of Kánara recorded 527 or 1·16 deaths, while in the remaining affected collectorates the rates were low. The rates per 1,000 for the various Registration Districts were as follows :—Western 6·01, Central 5·54, Southern 20·11, Gujarát 20·1, and Sind ·98.

In January there were 2,587 deaths reported, and during March they rose to 8,000. In April the deaths fell and continued to fall until the minimum (2,291) was reached in June ; they rose again in July, and a more distinct rise continued until October when the maximum, 25,193, was recorded, after which they continued falling until December in which 18,109 deaths were recorded.

There were 1,582 towns and villages affected by the epidemic, against 587 during the previous year.

Dysentery and Diarrhœa.—Dysentery and diarrhœa caused the deaths of 32,907 males and 27,291 females, or a total of 60,198 persons, against 218,243 in 1900, and a decennial mean of 64,788, a decrease of 158,045 against last year, and 4,590 less than the decennial mean.

The deaths ascribed to dysentery and diarrhœa during the seven years preceding 1897 showed only slight variations, but have since 1897 shewn a great increase. In the famine year of 1897 there was a sudden increase, which is but natural in a year of scarcity, and was repeated to an even greater extent in the year 1900. But in the year under report these deaths fell below the decennial mean.

The Central Registration District records the ratio of 5·35 per 1,000 of population, against 14·25 in 1900, and 4·73 the decennial mean. The Western Registration District comes next with a ratio of 4·50, the Southern Registration District 3·65, the Gujarát Registration District 1·32, and the Sind Registration District 0·21. In the Presidency the rate was 3·26, against 11·59 in the previous year, and a decennial mean of 3·44. All the collectorates excepting Dhárwár and Kánara show lower ratios than the previous year ; the highest ratio—8·12—was recorded in the collectorate of Sholápur, followed by Ahmednagar and Belgaum with 6·68 and 6·24. In the collectorates of Poona, Khándesh, Sátára, Bombay, and Násik, the recorded death-rates were 5·72, 5·60, 4·93, 4·85, and 4·43 respectively, while in Ratnágiri, Kolába, Dhárwár, and Kaira they were between two and three per 1,000 of population.

In each month of the year the deaths ascribed to these causes were lower than those of the previous year, and were also lower than the decennial mean in the months from April to October.

Injuries.—During 1901, 4,007 males and 3,085 females, or a total of 7,092 persons, met with violent deaths. The mortality from these causes is less by 1,132 than that reported in 1900, and corresponds within a unit with the five years' mean. Of the 7,092 deaths, 3,138 occurred from drowning, 1,199 from snake-bites, 841 from wounding, 187 from hanging, 121 from poisoning, 168 from attacks by wild beasts, and 1,438 from other causes.

Other Causes.—The recorded deaths from causes other than those specified, number 179,694, of which 91,961 occurred among males and 87,733 among females, lower than that for 1900 by 162,333. In all the registration districts there is a large decrease in the number of deaths as compared with the previous year. The highest number of deaths, 27,777, was recorded in the City of Bombay, followed by Dhárwár and Kaira with 22,490 and 14,333 respectively, and the lowest (117) in each of the districts of Thar and Párkar and the Upper Sind Frontier.

Sanitary Works.

During the year ending 31st March, 1901, there were 165 municipalities in the mofussil with a population, according to the Census of 1901, of 2,349,729 souls; the total income of these municipalities, including balance in hand on 1st April, 1900, amounted to £479,894. Out of this sum £95,168 was expended on improving the water-supply, drainage, and conservancy within municipal limits.

There are 23 District Local Boards, with 207 Táluka Local Boards; the entire income of these Boards during the year ending 31st March, 1901, amounted to £272,325, and out of this sum £11,566 was expended on water-supply and drainage.

The Bombay Village Sanitation Act of 1889 has been introduced into 292 villages, there being no increase in the number this year. It would appear that owing to famine and plague, which claims the attention of the District officers, no progress has been made.

The number of selected villages in which the Village Sanitary Inspection Book has been introduced, stands at 3,395; of this in about 1,545 villages the book has been written up by the officers of the Sanitary Department.

General Remarks.

The year opened with famine conditions prevailing in the collectorates of Ahmedabad, Panch Maháls, Broach, Khándesh, Ahmednagar, Sholápur, Poona, Násik, Sátára, and Bijápur. There were 28 famine relief camp and 18 poor-house hospitals open during the month of January, 1901, and the number gradually increased till July, when there were 55 famine relief camp and 15 poorhouse hospitals open at one time. The rains having practically failed in the Gujarát districts, and being below the average in some of the Deccan districts, famine conditions continued until the close of the year in the collectorates of Ahmedabad, Panch Maháls, Ahmednagar, Sholápur, and Bijápur. During the year under report there were 36,444 admissions into the famine relief hospitals and 6,134 deaths. The maximum number of admissions and deaths, 5,135 and 1,091 respectively, took place in the month of August, and the minimum in December, with 438 admissions and 192 deaths.

During the year 1901, 36,444 in and 117,808 out-door patients were treated in the 124 different famine relief camp and poor-house hospitals, and 6,134 deaths. The greatest number of deaths in camps, 2,114, occurred in the Sholápur district, followed by Ahmedabad with 1,189 deaths, Ahmednagar with 1,045, Bijápur with 803, Poona with 515, Panch Maháls 114, Belgaum 109, Sátára 98, Násik 81, Khándesh 62, Kaira 3, and Broach with 1 death.

The highest number of deaths, 2,479, was due to dysentery and diarrhœa, from which 991 deaths took place in the Sholápur district, and 582 deaths in the Ahmedabad district.

Cholera first made its appearance on the "Sholápur-Bellari Road" relief camp in the Bijápur district on 25th May, 1901, and spread gradually to most of the relief camps in that district, and 219 deaths were recorded. It then broke out at the Budhial Camp in

the Sholápur district on 10th August, 1901, and was confined to only four relief camps, with 280 deaths. The only other collectorate where famine relief camps were affected with cholera was Belgaum district, with 10 deaths.

There were 93 cases of small-pox, with only one death, in the Ahmednagar district. There were 7,757 cases of fever, of which 1,142 proved fatal. The highest number of deaths, 398 out of 2,964 attacks, took place in the Sholápur district. In the Ahmedabad district there were 1,257 attacks and 212 deaths.

One hundred and nineteen deaths were due to emaciation. Of this number 31 deaths occurred in the Sholápur district, 27 in the Ahmedabad district, and 24 deaths in the Ahmednagar district.

The highest number of admissions was from "all other causes," viz., 20,440, with 1,884 deaths. The highest number of deaths, 447, took place in the Ahmednagar district, followed by Sholápur with 419, Ahmedabad with 368, Bijápur with 250, and Poona district with 190 deaths.

ABSTRACT OF THE REPORT OF THE HEALTH OFFICER OF THE PORT OF BOMBAY FOR THE YEAR ENDING 31ST DECEMBER, 1901.

Summary.—During the year under report 34,637 vessels of all sorts with 886,310 crew and passengers, were examined, against 65,966 vessels, with 1,173,050 crew and passengers, during the year preceding. The decrease in the number of vessels, crew and passengers inspected is due to the fact that vessels sailing from the Port of Bombay for ports on the coast of the Kolába District as far south as Roha were exempt from medical inspection in accordance with Government Notifications No. 1697-P. of 17th April, 1901, and No. 3963-P. of 30th September, 1901.

The clothing and bedding of 70,914 native crew and third class or deck passengers who proceeded by vessels to ports out of India were disinfected. The baggage of 1,290 returning pilgrims, 2,671 deck passengers from jigger-infected ports, and 3,939 crew and passengers of other infected vessels which arrived in Bombay was disinfected. 83 vessels of all kinds on which cases of infectious disease occurred before departure from, or before or after arrival at, Bombay were disinfected. 868 crew and passengers were vaccinated owing to the prevalence of small-pox among them. At the outward and inward inspections and on board vessels lying in the harbour and docks 73 cases of plague, 5 cases of cholera, 34 cases of small-pox, 159 cases of measles, 67 cases of chicken-pox, 46 cases of jigger, 3 cases of leprosy, 4 cases of enteric fever, and 1 case of scarlatina were detected. Although it is not necessary to reject cases of chicken-pox, as that disease is not declared by the Government of India as an infectious disease dangerous to life, commanders of vessels, as a rule, refuse to take such people on board, as they are afraid to convey them to other ports where chicken-pox may be considered as an infectious disease.

Statement showing the summary of the shipping of the Bombay Port, and the work in connection therewith for the year ending 31st December, 1901 :—

Vessels, including Country Craft.	Total Number of Vessels.	Number of Vessels inspected.	Number of Persons inspected, including crew on vessels.	Number of Native Crew and 3rd Class or deck passengers disinfected during the year.	Number of Vessels disinfected.	Number of Persons vaccinated	Number of Persons segregated or rejected.	Diseases and Number of Cases of each.							
								Plague.	Cholera.	Small-pox.	Measles.	Chicken-pox.	Jigger.	Leprosy.	Enteric Fever.	Scarlatina.
Entered	*43,283	118	27,204	7,900	45	816	227	3	—	10	154	36	46	—	4	1
Left	*43,831	34,481	859,106	70,914	—	—	6,997	51	—	20	2	19	—	3	—	—
In harbour during the year	*1,192	38	—	—	38	52	—	19	5	4	3	12	—	—	—	—
Total for 1901 ..	88,306	34,637	886,310	78,814	83	868	7,224	73	5	34	159	67	46	3	4	1
Total for 1900 ..	—	65,966	1,173,050	77,162	122	2,777	17,314	84	85	1,392	28	19	125	—	—	—

* These figures are supplied by the Customs Department and the Port Officer, Bombay.

Incoming Vessels.—118 such vessels with 9,534 crew and 17,670 passengers were inspected on arrival. Out of this number 46 vessels entered the harbour with cases of infectious diseases on board. Of the 46 infected vessels, 5 were transports which arrived from Durban with 5,962 crew and passengers, including Boer prisoners. Among these prisoners 145 were found to be suffering from measles, 22 from chicken-pox, 1 from scarlatina and 4 from enteric fever. All these patients were taken over by the military authorities for treatment. The disinfection of the clothing and bedding belonging to the patients and to the crews of the vessels concerned was carried out on the new floating disinfection barge. 23 vessels arrived from East African Ports with 4,448 crew and

passengers, of whom 46 were found to be suffering from ulcers due to jigger. The jigger cases were sent to the Goculdas Tejpal Hospital for treatment. The clothing and bedding of 2,671 deck passengers, including those of the jigger patients, were disinfected at the new disinfection shed situated on the Frere Road, near Prince's Dock. The remaining 18 vessels with 3,940 crew and passengers had on board 2 cases of plague, 10 cases of small-pox, 9 cases of measles and 14 cases of chicken-pox. The disinfection of all the vessels infected, with the exception of one, and of the clothing and bedding of their crew and passengers was carried out in the usual manner. The exception was the S.S. "Setos," which collided with an outgoing steamer while entering the harbour on her arrival from East African Ports on the night of the 14th February, 1901, and was sunk. The crew and passengers of this vessel were saved and allowed to land during the night. As they were wet and had no shelter they were allowed to enter the town and were examined on the following morning.

Four vessels with 1,357 Australian horses and 10 mules were visited on their arrival at this port. The animals were examined by the Principal, Bombay Veterinary College, and certified to be free from tick pest or other contagious disease.

Outgoing Vessels.—During the year under report 34,481 outward bound vessels with 359,927 crew and 499,179 passengers were inspected. At the inspection 6,997 persons were rejected and prevented from sailing. Of the number detained in the Port Health Camp, 51 developed plague.

Of the 34,481 outgoing vessels with 359,927 crew and 499,279 passengers examined during the year, 315 vessels with 34,786 crew and 24,450 passengers left for Aden or ports in the Red Sea and Europe ; 610 vessels with 33,477 crew and 20,169 passengers for other ports out of India ; and the remaining 33,556 vessels with 291,664 crew and 454,560 passengers for Indian ports including Burma.

The clothing, bedding and suspected articles of 45,597 Asiatic and African members of the crew (excluding Japanese crew, who are specially exempt from disinfection) and of 20,432 third class or deck passengers and Asiatic and African servants who sailed on vessels bound for ports out of India were disinfected at the disinfection shed situated on the Frere Road, near Prince's Dock. The disinfection of the clothing and bedding of 4,164 crew of native sailing craft and 721 passengers conveyed by such vessels to ports out of India was carried out by means of the municipal stove attached to the Modikhana Hospital. Thus the total number of crew and passengers whose clothing and bedding were disinfected at the above-mentioned disinfection stations comes to 70,914 during the year under report, against 71,555 during the year preceding.

In certain cases the disinfection of the clothing and bedding of the Native crew of vessels bound for ports out of India *viâ* Karáchi was not carried out at Bombay, as disinfection is again done at Karáchi.

The disinfection shed was fitted with a second sterilizer, so as to enable the staff to get through the disinfection of the kit of crew and passengers of several vessels sailing at about the same time, so as not to cause any delay in their departure.

In addition to the medical examination of crew and passengers which was carried out by day on shore prior to the embarkation as required by the Venice Sanitary Convention Regulations, the ship's company was again inspected on board before the issue of a bill of health immediately before departure from this port. This means that the Native crew of almost all vessels proceeding to ports out of India were, as a rule, examined three times—firstly, when they were shipped ; secondly, when their clothing and bedding were being disinfected ; and thirdly, immediately before the vessel sailed. The first inspection referred to has to be carried out so as to meet the letter of the Venice Convention, but from a sanitary point of view it would appear to be unnecessary, and is, therefore, a waste of time and money, as most of the crew sleep on shore for several nights after the first shore inspection has been carried out.

In April, the "Sicilia" and in October the "Valetta" called at Bombay on their voyage to Colombo, merely to land troops, ordinary passengers and certain Government packages, and did not embark any passengers, or discharge, or take in any cargo here. Nothing was known as to the state of health of the crew and passengers already on board from ports outside Bombay, as they were not medically inspected here ; they came under the proviso of Rule 1 of the Medical Inspection Rules issued under Government Notification, General Department (Plague), No. 3892-P., dated the 14th June, 1899. The bills of health last obtained by these vessels before their arrival at the port of Bombay were accordingly endorsed as laid down in the Notification.

During the year under report 2,271 outgoing steamers and square-rigged vessels were examined. All of them were certified in the bills of health granted to them to have sailed from the Port of Bombay in a satisfactory sanitary condition. The commanders, agents, and nacodas of all outward bound vessels, including native sailing craft, with the exception of very few, were careful in paying attention to the sanitary state of their ships, and in almost all cases they have cheerfully carried out the instructions and advice of the Port Health Officer. The forecastles were limewashed, painted, or disinfected before departure. Owing to the large number of coolies who are employed in discharging coals and other cargo using the 'tween decks and holds of ships for the purposes of nature, it was found to be absolutely necessary to have the decks and holds of ships in ballast thoroughly washed down, and in most cases limewashed or disinfected before the vessel was granted a bill of health. 32,210 native sailing craft were inspected during the year. The bilges of the craft were generally clean at the time of inspection. Those that were found to be dirty or to contain foul water had to postpone their departures until thoroughly cleaned.

Infectious Diseases on Vessels in Harbour.—During the year under report 27 steamers and 11 native sailing craft which were lying at different berths in the Victoria and Prince's Docks and at the various bandars in the harbour, had on board 19 cases of plague, of whom 14 died, 5 cases of cholera, all of which proved fatal, 4 cases of small-pox, 3 cases of measles and 12 cases of chicken-pox. In addition to the above-mentioned cases, four persons (presumably dock labourers) were found dead at certain wharfs in the Prince's and Victoria Docks and at the Modi Bandar Inspection Shed. The cause of death in these cases was attributed to plague. All these vessels and those mentioned in paragraph 3 of this report, as well as the places where the coolies were found dead, were thoroughly disinfected according to the regulations issued under the Venice Sanitary Convention and the Indian Ports Act.

TABLE GIVING DETAILS OF INFECTIOUS DISEASES ON VESSELS WHILE LYING IN THE PORT OF BOMBAY DURING THE YEAR 1901 :—

Months.	Number of Persons who were attacked with Plague at Bandars and in the Docks.		Total Number of Cases of Infectious Diseases in the Bombay Harbour.									
			Total Number of infected Vessels.	Cholera.		Small-pox.		Measles.		Chicken-pox.		Plague.	
	Cases.	Deaths.		Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
1901.													
January	2	1	5	1	1	—	—	—	—	2	—	4	2
February ...	—	—	7	—	—	1	—	1	—	2	—	3	2
March	1	1	7	—	—	1	—	—	—	4	—	3	3
April	—	—	5	3	3	—	—	—	—	—	—	2	1
May	—	—	2	1	1	—	—	—	—	1	—	—	—
June	—	—	—	—	—	—	—	—	—	—	—	—	—
July	—	—	1	—	—	—	—	—	—	1	—	—	—
August	—	—	—	—	—	—	—	—	—	—	—	—	—
September ...	—	—	1	—	—	1	—	—	—	—	—	—	—
October	—	—	7	—	—	1	—	1	—	—	—	5	4
November ...	—	—	2	—	—	—	—	—	—	2	—	—	—
December ...	2	2	1	—	—	—	—	1	—	—	—	2	2
Total for 1901			38	5	5	4	—	3	—	12	—	19	14
Total for 1900			76	78	73	33	10	6	—	1	—	14	12

Port Observation Camp.—The area of land originally occupied by this camp, at a monthly rent of Rs. 175–10–1, between 10th January, 1899, and 31st August, 1900, was 25,000 square feet. On 1st September, 1900, the land was curtailed to 17,296 square

feet, for which a rent of Rs. 121-1-2 per month was paid to the Bombay Port Trustees. The latter area was occupied by the camp until 1st September, 1901, when it was further curtailed to 12,555 square feet, the monthly rent for which is now Rs. 87-14-2. The area of land referred to was curtailed owing to the recent policy of the Government regarding detention of persons in camps under observation.

This camp received persons who were rejected and sent there from the outward and inward inspections. They were kept under observation until their temperature fell to normal or until it was certain that the symptoms from which they suffered were not due to plague. Among the passengers and crew who were sent to the camp from the outward inspections, 51 developed plague and were transferred to the various plague hospitals in the city for treatment. The sheds of the camp in which the plague cases developed were thoroughly disinfected with perchloride of mercury and were kept unoccupied for some days. All the sheds were thoroughly disinfected twice a week with the standard solution of the perchloride of mercury. One hospital assistant and one ayah were employed to look after the inmates of the camp. The sweeping of the camp was done under arrangements made with the Public Health Department of the Bombay Municipality. The limewashing of the sheds, floors, &c., and the general repairs to the camp were carried out by the Executive Engineer, Bombay Presidency. One of the senior medical officers was detailed in turn every month to supervise the general working of the camp.

Disinfection of Ships and Infected Cargo.—The total number of infected vessels of all sorts disinfected under the personal supervision of the Health Officer of the Port, or of his staff and assisted by the harbour police was 83 during the year. The resident transport officer and the senior naval officer arranged for carrying out the Port Health Officer's recommendations for the disinfection of transports on which cases of infectious diseases occurred. In certain cases the disinfection barge was placed at the disposal of the marine authorities for carrying out the disinfection of linen, mattresses and the clothing and bedding of the crew belonging to infected naval and Indian marine ships or transports.

When disinfecting the vessels on which cases of cholera occurred, the drinking water stored on board such vessels was discharged into the sea and the water tanks were disinfected inside with potassium permanganate solution before they were re-filled with a fresh supply of drinking water.

In April, 1901, dead rats were found for days on board of a ship which was lying in the Prince's Dock. The vessel was disinfected in the following manner, as described by the captain :—

> " Sulphur was burned in the holds. The lower and the upper decks were washed and cleaned and then disinfected with a 5 per cent. solution of carbolic acid. There were three manholes for cargo which were swabbed with a solution of soft soap and carbolic acid and then dusted over with disinfectant powder. The walls and the roof of the manholes were sprayed with the same solution. The forecastles were washed with 5 per cent. solution of carbolic acid. The second class cabins as well as the bath-rooms and the water-closets (both deck and saloon) were also washed with the same solution."

General Health of the Shipping.—During the year 841 persons connected with the shipping were admitted into the various hospitals in the city suffering from diseases other than those considered by the Government of India as infectious diseases dangerous to life. The Saint George's Hospital admitted 457 European patients, of whom 9 died, 419 were discharged, and 29 remained after 1st January, 1902, under treatment. The Jamsetjee Jejeebhoy Hospital admitted 103 Native patients, of whom 13 died, and the Goculdas Tejpal Hospital 281 Natives, of whom 21 died. The diseases for which the patients in question were admitted were due to injuries, ague, simple continued, enteric and remittent fever, beriberi, syphilis, rheumatism, debility, diarrhœa, pneumonia, venereal, abscess, ulcers, &c., &c.

Red Sea Pilgrim Traffic.—The pilgrim traffic from Bombay to Jeddah has been stopped owing to the prevalence of plague in the former place since the year 1897 ; and consequently no vessels with Mecca pilgrims left this port for Jeddah during the year. The number of pilgrims who returned from Mecca *viâ* Aden and other routes during the year was 1290.

The Pilgrim Ships "Naseri," "Hooseinee" and "Pemba" had each a case of small-pox on the return voyage from Jeddah. The cases from the first two vessels were

landed at Karáchi and the case from the last vessel was landed at Aden. The necessary disinfection of the vessels and the clothing and bedding of the Hajees was carried out at Karáchi and Aden. On inspection here the crew and passengers of those vessels were found to be free from any infectious diseases.

The baggage of the 1,290 returning pilgrims was disinfected in the Port Health Disinfecting Stove. Pilgrims whose homes were up-country or beyond the frontier were not allowed to enter the town, but were sent direct from the disinfection shed to their homes by rail at the Government expense.

Sanitary state of the Harbour and Foreshore.—The sanitary state of the Bombay Harbour and Foreshore has continued to be the same as last year. The condition of the various bandars and docks has been reported as satisfactory during the year by the Customs Officers stationed at each bandar, with the exception of Clark Bandar, the condition of which is reported to be "not good." No complaints were made to the Port Health Officer by the residents in the vicinity of the Bombay Harbour as was customary some years ago regarding the insanitary and filthy state of certain bandars, and in the absence of such reports it is inferred that the present condition of the foreshore is as a rule, good.

Presence of Cholera and Small-pox and Epidemic of Plague in the City.—At least 18,736 deaths from plague, 198 deaths from cholera and 159 deaths from small-pox occurred in the City of Bombay against 13,286 deaths from plague, 4,273 deaths from cholera, and 3,018 deaths from small-pox during the year preceding. The City was free from epidemics of cholera and small-pox during the year under report, but plague was raging as a virulent epidemic from January to June inclusive in the year 1901.

The rigorous and very searching examination of each individual leaving this Port, the thorough disinfection of clothing, bedding and boxes of the Native crew, deck and third class passengers proceeding by vessels to ports out of India, and the rejection of persons suffering from suspicious symptoms of plague or other infectious disease have become so well known, that few persons actually suffering from fully developed plague symptoms attempt to travel by sea, as they know they are certain of being detected and detained in camp or hospital.

Whenever plague developed among the crew or passengers who were prevented from sailing on a vessel bound for a Foreign port, immediate intimation of it was sent to Government, with a view to communicating the fact by wire to the authorities at the next port at which the vessel was intended to touch. On the occurrence of a plague case among those who were rejected from vessels bound for Indian ports, the information was given by the Port Health Officer by wire to the next port for which the vessel was bound. This was done so as to give every information to other ports in case those rejections who developed plague may have relatives or friends among the people who sailed on the ship.

With one exception, no lines of vessels that left Bombay met with any vexatious delay owing to quarantine regulations at Foreign ports. This speaks volumes for the faith of Foreign Governments in the efficiency of the measures adopted by Government to prevent the spread of plague from Bombay by sea. The exception referred to is that of the British India steamers, which gave up calling at several ports in Portuguese East Africa on account of the enforcement of numerous vexatious regulations at those ports against arrivals from plague-infected countries.

The following outgoing vessels were reported to have had plague on board after leaving Bombay :—

(i) S.S. *Bormida* left for China on 17th January 1901. One of the passengers was found by the ship's doctor to be suffering from plague symptoms on the 20th January 1901. He died on the 21st idem.

(ii) S.S. *Assyria* left on 7th March 1901. On arrival at Karáchi one of her passengers was found to be suffering from plague.

(iii) S.S. *Parramatta* left on 12th October 1901 for the Far East *viâ* Colombo. A fireman serang is reported to have died off Colombo of plague and was buried at sea.

It was stated in the press that the S.S. *Peninsular*, which left Bombay on 2nd November 1901, landed at Marseilles two suspected cases of plague from among the lascars. From the reports obtained from the Superintendent, P. & O. Company, and their Agents at London and Marseilles, and also from enquiries made when the S.S. *Peninsular* returned to Bombay in January last, there is not the least ground to suppose that the men had plague. Both of them recovered.

The S.S. *Patiala* left Bombay on 26th November 1901 for Aden and East African Ports *viâ* Karáchi. One fatal case occurred among ordnance lascars and was removed at Aden on 5th December 1901. He found to be in perfect health at the time of his departure from Bombay. As the passengers from Bombay were allowed on shore at Karáchi—a plague-infected port—the deceased may have contracted plague there. The man is reported to have developed plague 5 days after leaving Karáchi or 8 days after leaving Bombay. The *Peninsular* and *Patiala* should not be counted against Bombay.

In addition to the above-mentioned cases, some cases of plague may have been exported from Bombay by coasting vessels to the small ports north and south of Bombay, but on the whole they must have been very few in comparison with the large passenger traffic which exists between Bombay and those ports.

Two vessels on their inward voyage were reported to have had cases of plague.

The decrease in the number of plague cases detected is due to the fact that a large number of the rejected were turned into the town and were therefore lost sight of, whereas in previous years they were detained in the various camps erected for that purpose until they showed clear signs of plague or until it was certain that the symptoms from which they were suffering were not due to plague.

In one instance a box said to contain plague-cultures was found by one of the Port Health Staff in the possession of a Surgeon on a ship which sailed from the docks for China. As the conditions laid down in the Rules issued under Government Notifications No. 2999-P. of 3rd May 1899 and No. 6048-P. of 4th October 1899 were not fulfilled the box was returned to the person from whom the Ship's Surgeon received it.

The question of clearing ships of rats at plague-infected ports, or on arrival from such ports at non-infected ports, has been under most careful consideration. Rats may indeed be killed by means of carbonic acid and other gases, but the cost of the operation and the difficulty of removing the gas from the hold of a vessel so as to enable human beings to work the cargo without danger to life and health appear to be at present impracticable. In addition to these and many other difficulties, there is nothing to show that gas liberated in the hold of a vessel will render innocuous plague microbes in the cargo of a vessel or in the body of infected rats on board of ship. I do not see how vessels can be completely freed from rats unless the vessel is empty of all cargo and ballast, and as this cannot be done in wet dock or stream without endangering the stability of the vessel, unless she is in water ballast, nothing short of sending her into dry dock, discharging her cargo there, and then filling the holds, forecastles, cabins and saloons with some poisonous or asphyxiating gas would be effective.

ABSTRACT OF THE REPORT OF THE CALCUTTA MUNICIPALITY FOR 1901-1902.

(*R. T. Greer, Esq., Chairman.*)

Water-supply—Filtered supply.—The Corporation have dealt with the question of providing a continuous water-supply and, having adopted the scheme which Government suggested, they anticipate the completion of the measure within the period prescribed by law.

In view of the statutory obligation of the Corporation, regarding the conversion of the present intermittent system of filtered water into a continuous supply, the Chief Engineer, in April, 1901, submitted a scheme recommending, among other things, the construction of elevated reservoirs, which, he contended, would do away with the necessity of maintaining the existing Pumping Stations at Wellington Square and Halliday Street. He also recommended that the opinion of an expert should be taken on the subject. The General Committee determined to consult the Government, with the result that Messrs. Buckley and Silk were deputed (under Section 22 of Act III., Bengal, 1899) to examine the existing water-supply of Calcutta with a view to ascertain the best and most economical method of introducing a continuous system of supply. In their final report these officers urged the necessity of a careful test being made of the mains and branches to check the existing waste, the enlargement of the storage capacity at Tallah, and suggested means by which the continuous system might be gradually introduced into the City. They did not approve the Municipal Engineer's recommendation in regard to elevated reservoirs, and were of opinion that the existing pumping power, with slight alterations at two of the power stations, would be found to be sufficient to admit of the conversion of the intermittent into a continuous supply. This report was finally adopted by the Corporation on the 7th May, 1902. The cost of the conversion is estimated at about £100,000.

Steps are now being taken to construct an additional reservoir at Tallah, with a capacity of 5,000,000 gallons, at a cost of £16,520. A supply of waste water and positive water meters have been ordered and a definite area has already been brought under a continuous supply. As there is no apparent hindrance to the work, the system should be extended to the entire city area within the period prescribed in the Act.

Measures have been undertaken also to increase the efficiency of the arrangements at Pulta. The system of sand-washing is being improved and the analysis of water is being carried out in greater detail. The Health Officer reports that the quality of the filtered water compares very favourably with that of the largest towns in Europe. Three new engines are being supplied at a cost of about £15,600. The question is being considered of increasing the number of sand-filters and of more frequently renewing the filter-beds.

In this connection it may be mentioned that a Green's economiser has been erected at Tallah at a cost of £430.

The quantity of filtered water pumped through the mains during the year was 7,457,841,070 gallons, giving a daily average of 20,433,227 gallons, the gross cost per 1,000 gallons being 2·8 annas. The total expenditure debitable against the Water-supply Fund amounted to £93,700. The receipts from the sale of water totalled £11,390, a decrease of about £400 as compared with 1900–01, when a large number of transports for China were supplied with water. The consumption of filtered water per head of the population during 1901–02 was 24·22 gallons per day. The total mileage of filtered water mains and services in both the town and added areas on the 31st March, 1902, was 316·85 miles, the number of standposts in the town area being 955 and in the added area 1,040.

A new steam water-boat has been provided at a cost of £5,500 for the supply of filtered water to ships. The growing demand necessitated this outlay, the old water-boats being insufficient for the work.

Unfiltered supply.—Arrangements are being made to extend the supply during the current year to all the sewered roads throughout the City. The cost is roughly estimated at £38,560 and due provision has been made in the Budget. The supply has been extended for a length of 12,195 feet during the year. The total mileage of unfiltered water pipes on the 31st March, 1902, was 158·15 miles.

The extension of the unfiltered water supply will directly relieve the demands for filtered water in hundreds of privies throughout the town. The cost of this change will fall upon the Corporation and prove beneficial in the saving effected in the use of filtered water.

Suburban drainage.—The Corporation have taken in hand the Suburban Sewerage Scheme, which had made but little progress during the past few years. In 1896 Messrs. Hughes and Kimber submitted, subsequent to the visit of Mr. Baldwin Latham to Calcutta, a Joint Report embracing a scheme for the sewerage of the suburban area, improvements to the town area, Palmer's Bridge Pumping Station and Outfall works. Their recommendations did not agree with those suggested by Mr. Baldwin Latham, but received the general approval of the Government in January, 1897, on the understanding that particular sanction should be obtained for the details of the project on the plans and estimates being worked out. In May, 1901, the sanction of Government was obtained to the works embraced on the Outfall section under Contract II., at a total cost of £196,200. The works completed in whole or part under this sanction include the Town and Suburban Storm-water Channel and Open Sewage Channel, the Town High-Level Sewer and two sluices at Byntolla.

A further reference was made to Mr. Baldwin Latham in January, 1901, and he submitted a report in September, recommending that tidal action should be brought into operation at a point a few yards to the east of the railway line, near the Ballygunge Rifle-range, thereby doing away with the necessity for a pumping station at Ballygunge, the Suburban High-Level Sewer, and the pumping station and sluices at Byntolla. His report was referred to a Sub-Committee of Engineers, who, after carefully considering the subject in consultation with the Chief Engineer of the Corporation, submitted a report in which they declared that the discharge of crude sewage into an open *khal* at the point indicated by Mr. Latham would result in the creation of an intolerable nuisance to the inhabitants of Ballygunge. They therefore urged the necessity of conveying the sewage through a High-Level Sewer to a point 5,000 feet further east, to the junction of the Suburban and the Town High-Level Sewers. The second portion of the scheme, which includes the completion of main sewer No. 1 (from Kidderpur to Ballygunge), the construction of a pumping station at Budge-Budge, a syphon under Tolly's Nullah, a Suburban High-Level Sewer, and a pumping station at Ballygunge, has since been approved and sanctioned by the Government of Bengal.

The Corporation accordingly have decided to complete Main Sewer No. 1 and its outlet as soon as possible, so as to give relief to those residing in the badly-drained tract which it traverses. The sewer is practically complete throughout Kidderpur and Alipur and for the greater part of the distance between Tolly's Nullah and Ballygunge. The construction of the remaining main sewers has been approved by the Corporation and the necessary details are being prepared. Action is being taken by the Engineer's Department for the preparation of a surface drainage scheme for the suburbs and this should be considered by the Corporation during the current year. The lamentable state of the drainage in the suburban area, the unhealthiness of the locality, and the high death-rate, undeniably point to the urgent need for action.

Engineering and Conservancy.—The new District Scheme also came into operation during the year. Under it the Engineering Department has charge of Conservancy, the Health Officer being left to discharge the duties more directly concerning the health of the City. District No. I, which comprises Wards 1 to 6, was equipped on the 1st July, 1901, Mr. W. Johnstone being appointed District Engineer, Dr. R. Sen, District Health Officer, and Babu Abinash Chunder Roy, District Building Surveyor. The district worked satisfactorily, and in December the Commissioners unanimously approved the extension of the scheme to the other portions of the town. Districts II (Wards 7 to 12), III (Wards 13 to 17, inclusive, and 19 and 20) and IV (Wards 18 and 21 to 25 inclusive) were, accordingly, equipped on 1st January, 1902, the District Engineers being Mr. P. B. LePatourel, Babu J. C. Aich, and Mr. A. E. Chapman, respectively. It was considered advisable to give a trial to existing men on the staff of the Corporation in the new offices of District Engineers. The Government of Bengal have lent the Corporation the services of three members of the Subordinate

Medical Service, namely, Messrs. Maloney, Harvey, and Mansfield, for the posts of District Health Officers. The first-named has since been transferred to the Plague Department, and his place has been taken by Mr. P. R. Roy, D.P.H. The establishment of District Offices forms a material part of the scheme. Three of the posts of District Building Surveyors were given to men on the establishment, the services of a qualified Licentiate of Engineering being secured for the fourth vacancy. A complete staff for the discharge of business in the Department of the Engineer, Building Surveyor, and Health Officer, accordingly is engaged at No. 26, Cornwallis Street for District No. I; at No. 118-1, Bow Bazar Street for District II; at No. 1, Municipal Office Street for District III; and at No. 9, Belvedere Road, Alipur for District IV.

The extension of the system to the Departments of the Collector and Assessor is a subject for the future consideration of the Corporation.

The outturn of work in the Engineering Department was less than in the previous year mainly owing to the stoppage of work on the Suburban Drainage Scheme.

The works on hand in the Department constitute a formidable list, and include the following in various stages of execution:—Extension of the continuous water-supply scheme £27,000, extension of the unfiltered water supply to all sewered streets £31,000, construction of a new reservoir at Tallah £16,600, introduction of a new system of sand-washing at the filter-beds £1,650, erection of three new engines at Pultah £20,940, resumption of work in connection with the Suburban Drainage Scheme £93,000, extensive repairs to the two existing Gowkhanas £8,110, and construction of two new ones in Districts Nos. I and IV £16,400, construction of a new Dhobikhana in District No. I £700, the laying out of six new squares £10,900, reconstruction of Tangra Cattle slaughter-house £3,300, and provision of a slaughter-house for goats and sheep in each district, construction of new district office buildings in Districts I and IV £6,700, extensive addition to the Municipal Market £5,300, and construction of a new market in Lansdowne Road £4,700, construction of the new Municipal Office Building £40,900 construction of a new vaccine depôt £2,700, and of four district vaccination stations £1,300, construction of a contagious diseases hospital, erection of a refuse-destructor at Entally £11,600, acquisition and demolition of Ghoomghur Bustee, and the re-construction of roads and buildings in that area £11,700.

The Chairman has reason to believe that the public generally appreciate the District Scheme as it lends itself to greater despatch in business, secures better control, and fixes responsibility on individuals. The ratepayers are now afforded a ready means of representing their complaints in their departments and of obtaining more prompt attention. The four district officers are in telephonic communication with the chairman's office, and the district officers are thus in close touch with the heads of departments.

The effect of the change will not be fully experienced until a staff of qualified men have been secured for the new scheme. Wherever possible, the old hands have been given a trial in the new posts. The scale of salaries under the scheme is sufficiently high to attract competent men, and as vacancies occur in the ranks, better qualified men are being engaged.

Plague.—Plague recrudesced in the middle of January, after the usual quiescent period from June to December. The epidemic followed much the same course through the city as before, attaining a maximum in the first week in April spreading from the central wards towards the north, and afterwards to the southern portions of the town. The beginning of the epidemic was earlier, its growth less rapid, and without reaching the same degree of intensity, its decrease took place at a later date and at a slower rate. The total number of deaths reported during the epidemic in 1902 is shewn as 6,925, as compared with 7,398 in the previous year, attacks during these periods being reported as 7,418 and 8,117 respectively. The disinfection of plague-infected rooms has been persistently carried out with the result that only about half a dozen instances are known of plague recurring in rooms after disinfection. The disinfection of adjoining rooms has been carried out where practicable and with good results. Many disinfections have been done on account of the death of rats, and in many cases human plague has not subsequently appeared at the site.

The plague measures during the period have been extended in the direction of demolishing huts which had proved to be plague-spots and centres of disease. Early in the epidemic a number of most insanitary huts were thus removed in Roop Chand Roy's Street in Ward VII. The plague returns shewed 300 fewer cases in this Ward than in the previous year. A similar remark applies to Ward V where demolition was carried out extensively in Hanspuker Bustee.

Compensation was duly paid to the hut-owners, and the work was carried out with as little inconvenience as possible to the parties. In the majority of cases the owners themselves demolished the structures. The results are very encouraging, and offer hopes of much future success in the work of clearing away insanitary dwellings. The outbreak caused little alarm in the city, and the inhabitants, apparently, are beginning to regard the disease as a normal visitant.

A proposal has been made to amalgamate the Plague Department with the ordinary staff, utilising the services of the Special Plague Medical Officers as District Health Officers. The arrangement has not yet been approved by the Government.

Forty inoculations were performed during the year. The public were left a free choice, opportunities being given to them for inoculation without any pressure for or against the measure.

The actual expenditure during the year 1901–1902 has been £19,800. According to an order of Government the expenses against plague in future will form part of the ordinary expenditure of the Corporation.

Bustee Improvements.—Owing to the failure of the proceedings under Section 400, to secure the necessary improvement, and to the existence of plague in bustee areas, the energies of the Corporation were mainly directed to action under Section 406.

Six bustees are being dealt with under Section 400, in four cases the owners being required to carry out certain prescribed improvements.

Ninety-seven bustees have been taken up for improvement under Section 406, and 27 standard plans have been sanctioned. The improvements prescribed in these plans will secure wide roads, proper drainage and latrine arrangements, and adequate space for ventilation. In seven cases the owners have commenced the prescribed work, and the Corporation are prepared to carry out the necessary improvements in the remainder at the expense of the owners on the failure of the latter to comply with the requirements of the law.

Dwellings for the Working Classes.—The difficulty of designing suitable dwellings for the poor is felt to an exceptional degree in this city. Special objections exist on account of caste and local customs, while, in view of the low cost of rooms in bustees, it is almost impossible to erect buildings of a sanitary class to compete with huts at remunerative prices. An experiment was made during the year by two zemindars, Messrs. Sita Nath and Janaki Nath Roy, in the erection of a block of masonry buildings at a cost of about £3,300, according to the design of the model dwellings of the Bombay Improvement Trust. There appears to be room for many such buildings in Calcutta to supply the wants of clerks, students, and the artizan classes. The measure is specially valuable as an example to land-owners, and an experiment towards the solution of one of the most difficult questions in municipal administration. A less expensive design is required to meet the case of bustee-*wallahs* who are accustomed to pay small fees for shelter in insanitary and overcrowded rooms of huts. The Corporation have sanctioned the acquisition of an unhealthy bustee in Ward No. 10, at a cost of £11,720. In addition to clearing away insanitary dwellings and constructing a highway through the tract, it is hoped that something may be done in the way of erecting model dwellings for those who will be disturbed by the change. Plans for model bustee cottages have been designed. It is proposed to experiment with them in housing the labourers in the employment of the Corporation.

Building Department.—The foundation of the Building Department was a feature in the work of the year. Formerly operations under the Building Regulations had been carried out by the Engineer's Department as a work of secondary importance. As a consequence complaints were general, and little attention was given to the Building Regulations. Four District Building Surveyors have been appointed with the necessary subordinate staff, the Department being directly under the Deputy Chairman.

Cemeteries.—The Health Officer strongly reported against intra-mural burials on account of the danger to the public health, and the Government, on the recommendation of the Chairman issued an Order, in February last, directing the closing of the following cemeteries and burial grounds:—(1), South Park Street Cemetery; (2), North Park Street and Mission Cemetery; (3), Tiretta Cometery; (4), Portuguese Church Cemetery, 15, Portuguese Church Street; (5), Boytakkhana Church Cemetery; (6), Greek Church Cemetery, 8, Amratolla Street; and (7), Mosque Burial-ground, 86, Nimtola Ghât Street.

The Corporation in January, 1902, appointed a Special Committee to enquire into and report upon the arrangements for burying, burning and otherwise disposing of the dead in Calcutta, the Committee being asked to take up the question of the Christian Cemetery on the Circular Road as an urgent matter.

This Committee accordingly recommended that land be acquired for a City Cemetery sufficiently large for the requirements for about 50 years, and that meanwhile an extension of the existing cemetery on the Lower Circular Road be granted to the extent of 10 bighas to supply immediate wants. The Corporation have approved the recommendations of this Committee. Ten bighas of land have been taken up as an extension of the existing cemetery, and a new site, measuring 200 bighas, has been chosen for a new City Cemetery near Jadubpore Police Thana, at a cost of £3,200. Everything possible will be done to suit the convenience of the public in using the new City Cemetery, and negotiations are taking place for the extension of the Electric Tramway service to that place.

During the year the Corporation provided two new burial-grounds for Mahomedans in the north and south of the City, the existing grave-yards being altogether unsuitable. An area of 22 bighas has been acquired accordingly at Bagmari, at a cost of £1,350, and 29 bighas at Gobra, at a cost of £1,610. The sites have been approved of by the Mahomedan Burial Board, and the new burial grounds will supply a long-felt want.

Refuse Destructors.—The use of destructors for the disposal of refuse in Calcutta has received considerable attention during the year. In its present condition the existing incinerator at work in the suburbs would be regarded as a public nuisance in the crowded parts of the town. Elsewhere, the efforts of the Corporation have twice failed to introduce incineration in past years. The Commissioners therefore considered it proper to require that reasonable security should be secured for the proper working of the destructor before undertaking further risk.

After a careful investigation of the subject, the Corporation accepted the offer of Messrs. Joseph Baker & Sons, of London, for the supply of a nine-cell destructor. The apparatus will be erected at Entally, with a capacity for the disposal of all the refuse which at present is conveyed to Platform No. IV, amounting to about 140 tons a day. The plant will cost £770, and if, at the end of eight months' trial (including one wet season), the incinerator fails to prove efficient or is found to be a nuisance, the contractors have guaranteed to refund two-thirds of the total cost. The sanction of Government has been obtained to the project, and the experiment will be carried out in the course of the current year.

The success of this measure will, in all probability, accelerate the removal of the municipal refuse train from the Circular Road. The existence of this train is a grave disfigurement, and checks the development of property in that neighbourhood. The Commissioners await the result of the experiment at Entally before applying the system at several appropriate sites. The establishment of destructors would greatly assist the Conservancy Department.

Slaughter-houses.—The Municipal Saughter-house at Tangra has been placed under the charge of the Market Sub-Committee, and many useful improvements have been suggested by them. The work of re-organisation will be carried out during the current year, the necessary expenditure on buildings being estimated at about £2,300.

The need for cattle slaughter-houses in the south-west suburbs and the north of the town has been brought to notice, and the subject is receiving attention. Meanwhile arrangements are being made to provide a slaughter-house for kids and goats in each district. Illicit slaughtering is common and a want exists for slaughter-houses in sites convenient to the public.

Health Department.—Under the Re-organisation Scheme a fully qualified Medical Officer is stationed in each district as District Health Officer with the needful clerical staff.

Fifteen Sanitary Inspectors are provided on salaries sufficient to attract competent medical men. The original scheme contemplated leaving food inspection in the hands of these officers. Experience, however, has shewn the need for additional attention to this duty, and the Corporation has sanctioned the appointment of a qualified Medical Officer as Food Inspector in each district.

Improvements are in view in the collection of vital statistics in the employment of the Sanitary Staff to check the mortuary returns by local enquiries.

The meteorological changes were not attended by any appreciable effect on the mortality, which, except for the first three months of the year, was below that of the corresponding period of the previous year. The higher mortality of the first quarter was caused by plague, and cannot be associated with the slight changes in meteorological conditions. Apart from an outbreak of small-pox at the same time as the plague epidemic there was no special feature in the vital statistics of the year.

The usual chemical and bacteriological work was carried on chiefly in testing water, ghee, milk, butter, arrowroot, barleypowder. An important judgment was delivered during the year in favour of the Corporation in a prosecution for the adulteration of ghee. The accused was one of the largest wholesale vendors, and the proceedings may be regarded as a valuable test case.

The necessary apparatus for examining the illuminating power of gas was received during the year, and work was carried on accordingly.

The low birth-rate continues to form a prominent feature in the statistics. In the opinion of the Health Officer the cause is largely due to the want of efficient registration. The Committee, when dealing with the Re-organisation of the Health Department, considered that better results might be expected regarding the collection of birth statistics from the services of Hospital Assistants as Vaccinators.

The Health Officer reports the year as comparatively unhealthy, the death-rate, excluding plague, being 28·9 as against a mean of 27·4 per 1,000 during the previous ten years. An epidemic of small-pox accounted for 2,097 deaths, the mortality from cholera and fever being below the average. Including plague, the returns, however, shew an improvement in the public health, the registered death-rate being 38·2 per 1,000 as compared with 43·5 in 1900–01. The Health Officer refers to the occurrence of 30 cases of epidemic dropsy in the month of June, and is unable to account for the appearance of the disease or its sudden disappearance.

Under the Re-organisation Scheme the work of vaccination has been placed in charge of the District Health Officers. A staff of hospital assistants has been provided for the work in place of men possessing no qualification. A female vaccinator has been provided for each district. Arrangements are being made to provide suitable vaccination offices. Owing to irregularities in procuring a supply of lymph the Corporation have decided to establish a special vaccine depôt for its own requirements. Although the arrangements were not complete throughout the year, the results are satisfactory, the number of vaccinations (35,630) being the largest on record, except during a specially severe epidemic in 1895. The number of primary vaccinations (17,820) is the highest on record. The percentage of success in primary cases was 98·3.

The Corporation have decided to establish a vaccine depôt for their supply of lymph. A site has been selected, and plans have been prepared according to modern principles. The Corporation have allotted £2,700 in the Budget for carrying out the work.

The establishment of new vaccination stations has been approved, £1,670 having been sanctioned for the scheme. It is proposed to construct an office in each district, the buildings to be rendered as attractive as possible to the public.

ABSTRACT OF THE REPORT OF THE HEALTH OFFICER OF CALCUTTA FOR 1901.

(*Dr. J. Nield Cook.*)

Births.—The birth-rate of the town calculated on the registered births was 10·7 per 1,000 of the population. Judging from towns where the births are better registered than they are in Calcutta I calculate that a normal Indian birth-rate should not be less than 40, making allowance for the fact that in Calcutta the female population is only half the male I estimate the normal birth-rate at 20. If this is anywhere near the correct figure it would appear that nearly half the births escape registration. We have Sub-Registrars sitting in Offices in different parts of the town who register any births of which information is brought to them, but the bulk of the people either don't know anything about it or don't take the trouble to register the births that occur in their families, and we have no efficient system of getting information of these births to enable us to bring pressure to bear on the parents and guardians to register them. I have from time to time recommended the licensing of all practising midwives and requiring them to give information of births. I brought this suggestion up again during the year, but the Commissioners and Government considered it too drastic, so it was not adopted. When this was refused I requested sanction for subordinate officers under the Sub-Registrars to go about the District making inquiries, but this did not meet with the approval of the Commissioners. The want of efficient registration of births makes some of our other statistics unreliable or even misleading, as for instance, the proportion of infants dying under one year of age to every 1,000 births, and throws difficulties in the way of our Vaccinators whose work would be much easier if they had a complete record of all the births that occurred.

Deaths.—The abnormally high death-rate of 38·2 per 1,000 of the population was due to plague. If we eliminate that disturbing factor from the mortality of the year under review and also from the mortality of the previous ten years the death-rate works out at 28·9 against a mean of 27·4. So that if all the plague deaths were registered as such, the year was comparatively a somewhat unhealthy one. This may be attributed to an epidemic of small-pox which accounted for 2,097 deaths, the mortality from cholera and fevers being below the average and that from dysentry and diarrhœa only slightly above it. The epidemic of plague which occurred in the early part of the year will be dealt with separately by the Special Health Officer. Of special diseases influenza was amongst us, but I have no reliable data on which to base a calculation of the extent to which it affected the mortality. I believe that a number of deaths attributed to pneumonia and other diseases of the lungs were primarily due to this cause. A number of cases of cerebro-spinal fever were reported in jails and emigration depôts. 23 deaths were registered under enteric fever, many of the cases being verified by Widal's agglutination test, but the specific bacillus was not found in the town water, and though sanitary defects were present in the surroundings of several of the cases there was no sufficient evidence to establish with anything like certainty the source of the infection. In June about thirty cases of epidemic dropsy, similar in all respects to those formerly described by Col. Kenneth McLeod, I. M. S., occurred in the town. Eleven of the cases occurred in a native college for ladies. The first case was a matron who had returned five days before from a holiday at Nuddea. I wrote to the Civil Surgeon who replied that no case of the disease had occurred there. All the sanitary arrangements of the college were good, and the pupils were well nourished. I am unable to account for the appearance of the disease, or its rapid disappearance which was contrary to precedent. No cases ended fatally.

The following statement shows the mortality from the principal diseases in 1901 compared with the average of the previous five years.

1. No. of Wards.	2. Names of Wards.	3. Population according to Census of 1901.	4. Cholera.	5. Small-pox.	6. Fever.	7. Dysentery and Diarrhœa.	8. Plague.	9. Injury. Suicide. Male.	Suicide. Female.	Wounds and Accidents.	Snake-bite or by Wild Beasts.	Total.	10. All other Causes.	11. Total Deaths from all Causes.	12. Ratio of Deaths per 1,000 of Population. Cholera.	Small-pox.	Fever.	Dysentery and Diarrhœa.	Plague.	Injury.	All other Causes.	From all Causes. For the Year.	Mean of previous Five Years.
1	Shampooker	46,887	141	187	334	166	470	6	3	14	—	23	546	1,867	3·0	3·9	7·1	3·5	10·0	·49	11·6	39·8	27·9
2	Coomartolly	30,155	141	79	210	147	473	5	5	5	—	15	383	1,448	4·6	2·6	6·9	4·8	15·6	·49	12·7	48·0	34·5
3	Burtollah	50,216	111	211	401	169	513	8	3	11	—	22	674	2,101	2·2	4·2	7·9	3·3	10·2	.43	13·4	41·8	29·3
4	Sukea's Street..	42,034	56	136	349	145	230	3	5	15	—	23	621	1,560	1·5	3·2	8·3	3·4	5·4	·54	14·7	37·3	28·3
5	Jorabagan	49,069	165	81	325	167	1,472	6	3	30	—	39	473	2,722	3·3	1·6	6·6	3·4	29·9	·79	9·6	55·4	35·5
	Mayo Hospital	—	9	—	3	5	—	1	—	1	—	2	11	30	—	—	—	—	—	—	—	—	—
6	Jorasanko	52,988	109	115	389	220	552	4	4	10	—	18	713	2,116	2·0	2·1	7 3	4·1	10·4	·33	13·4	39·9	32·1
7	Burra Bazar	31,574	76	37	239	85	749	—	1	10	—	14	216	1,413	2·4	1·1	7·5	2·6	23·7	·34	6·8	44·7	28·0
8	Colootollah	63,170	110	281	477	152	622	3	—	16	—	20	698	2,260	1·7	4·4	7·5	2·4	9·8	·31	11·0	37·3	29·2
	Medical College Hospital ..	—	7	—	13	6	17	2	—	12	—	14	130	187	—	—	—	—	—	—	—	—	—
9	Moocheepara	64,116	87	182	498	146	465	6	2	17	—	27	844	2,249	1·3	2·8	7·7	2·2	7·2	·42	13·1	35·0	28·4
	Police Hospital . ..	—	1	—	1	2	—	—	—	—	—	—	7	11	—	—	—	—	—	—	—	—	—
10	Bow Bazar	27,052	21	89	171	75	200	1	—	8	—	9	334	899	·77	3·2	6·3	2·7	7·3	·33	12·3	33·2	28·9
11	Puddopooker	28,060	42	80	182	93	152	1	2	5	—	8	330	887	1·4	2·8	6·4	3·3	5·4	·28	11·7	31·6	25·1
12	Waterloo Street	6,395	13	5	23	9	30	1	2	1	—	4	38	117	2·0	·78	3·6	1·4	4·6	·62	5·1	18·2	17·5
13	Fenwick Bazar	31,242	28	75	166	78	457	1	—	7	—	8	301	1,133	·89	2·4	5·9	2·5	14·6	·25	9·6	36·2	26·0
14	Taltollah	32,237	50	96	250	113	280	1	—	3	—	4	400	1,193	1·5	2·9	7·7	3·5	8·6	·12	12·4	37·0	31·1
15	Collinga..	16,780	11	18	178	62	81	—	—	2	—	2	195	547	·65	1·0	10·6	3·6	4·8	·11	11·6	32·5	26·0
16	Park Street..	6,127	3	8	28	15	33	—	—	3	—	3	40	130	·48	1·3	4·5	2·4	5·3	·48	6·5	21·2	12·8
17	Bamun Bustee	5,503	2	5	16	9	20	—	—	3	—	3	42	97	·36	·90	2·9	1·6	3·6	·54	7·6	17·6	25·8
18	Hastings	4,444	9	5	90	22	24	2	—	2	—	4	76	239	2·0	1·	22·2	4·9	5·4	·90	17·1	53·7	47·9
	Military Hospital	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total	588,049	1,201	1,690	4,372	1,886	6,840	51	33	175	—	259	7,067	23,315	2·0	2·8	7·4	3·2	11·6	·44	12·0	39·6	29·8
	Fort William	4,612	—	—	33	5	—	1	—	3	—	4	24	66	—	—	7·1	1·0	—	·86	5·2	14·3	11·4
	Port of Calcutta	29,762	78	8	34	5	—	—	—	46	—	46	10	181	2·6	·26	1·1	·16	—	1·5	·33	6·0	7·2
	Grand Total ..	622,420	1,279	1,693	4,439	1,896	6,840	52	33	224	—	309	7,101	23,562	2·0	2·7	7·1	3·0	10·9	·49	11·4	37·8	28·6
19	Entally	38,626	96	161	451	152	269	3	1	13	1	18	515	1,662	2·4	4·1	11·6	3·9	6·9	·46	13·3	43·0	39·0
	Campbell Hospital	—	30	24	163	531	83	—	1	5	—	6	498	1,335	—	—	—	—	—	—	—	—	—
20	Baniapooker	28,202	19	44	312	100	98	1	2	11	—	14	409	996	·67	1·5	11·0	3·5	3·4	·49	14 5	35·3	32·1
21	Ballygunge and Tallygunge	27,207	48	34	223	124	56	2	—	5	—	7	503	997	1·7	1·2	8·1	4·5	2·1	·25	18 4	36·6	31·4
22	Bhowanipur	49,641	126	92	414	165	194	—	1	14	1	16	766	1,773	2·5	1·8	8·3	3·3	3·9	·32	15·4	35·7	31·1
	General Hospital	—	2	1	2	6	—	—	—	—	—	—	18	29	—	—	—	—	—	—	—	—	—
	Shumbu Nath Hospital ..	—	—	—	1	2	—	—	—	1	—	1	44	48	—	—	—	—	—	—	—	—	—
	European Lunatic Asylum	—	—	—	—	1	—	—	—	—	—	—	2	3	—	—	—	—	—	—	—	—	—
	Alipur Lock Hospital ..	—	—	—	—	1	—	—	—	—	—	—	1	2	—	—	—	—	—	—	—	—	—
	Do. Jail Hospital ..	—	—	—	4	1	—	—	—	1	—	1	19	25	—	—	—	—	—	—	—	—	—
	Do. Police Hospital ..	—	—	—	2	3	—	—	—	1	—	1	4	10	—	—	—	—	—	—	—	—	—
	Do. Police Case Hospital	—	—	—	1	—	—	2	2	3	—	7	—	8	—	—	—	—	—	—	—	—	—
23	Alipur	17,718	38	21	69	55	31	1	1	5	—	7	191	412	2·1	1·1	3·8	3·1	1·7	·39	10·7	23·2	23·3
24	Khidderpur and Ekbalpur	21,608	18	7	99	82	65	1	—	9	—	10	412	693	·83	·32	4·5	3·8	3·0	·46	19·0	32·0	33·3
25	Watgunge and Garden Reach	37,918	62	15	130	92	245	1	—	15	—	16	338	898	1·6	·39	3·4	2·4	6·4	·42	8·9	23·6	22·8
	Total	220,920	439	399	1,871	1,315	1,043	11	8	83	2	104	3,720	8,891	1·9	1·8	8·4	5·9	4·7	·47	16.8	40·2	37·1
	Canal	4,447	2	—	1	—	—	—	—	—	—	—	—	3	·44	—	·22	—	—	—	—	·67	5·8
	Grand Total ..	225,367	441	399	1,872	1,315	1,043	11	8	83	2	104	3,720	8,894	1·9	1 7	8·3	5·8	4·6	·46	16·5	39·4	36·5
	Combined Total ..	847,786	1,720	2,097	6,311	3,211	7,883	63	41	307	2	413	10,821	32,456	2·0	2·4	7·4	3·7	9·2	·48	13·7	38·2	30·7

Vaccination.—Under the new system of work introduced by the formation of four Districts into which Calcutta is now divided the Vaccination Department has been abolished. The old Vaccinators have been replaced by Hospital Assistants placed directly under the District Health Officers. The post of the Deputy Superintendent of Vaccination has, therefore, been abolished. The total number of vaccinations done during the year was 35,630 the largest number that has ever been done in Calcutta except in 1895, when a severe epidemic of small-pox occurred. The number of primary vaccinations was 17,820 of which 16,899 were children. This is the largest number of primary vaccinations done in Calcutta in any year. The number of primary vaccinations is considerably larger than the number of births registered in the town. The number of births registered was 9,129. I have estimated this at half the true figure. If this is correct 17,820 primary vaccinations were done to 18,358 births which leaves only 538 unprotected. The percentage of success in primary vaccination excluding the unknown was 98·3. The percentage of success in re-vaccination was 51·8. For some time past we have been dissatisfied with the supply of operated calves and preserved lymph by the Government Animal Vaccine Depôt. So I made proposals to the Commissioners to construct a depôt of their own on approved modern principles. This received sanction. A site has been selected, and plans drawn up by the Engineer in consultation with myself, and £2,700 have been budgeted for carrying out the work which I hope to see completed in the next six months. One of my proposals for improving vaccination in the town was to have good district Vaccination Depôts that would be attractive to the public, —a pagoda with a broad verandah where the people could wait with a space round with a few plants. This received the approval of Government, and the Commissioners budgeted £1,670 for the purpose. I have recommended some sites and expect that a start will soon be made.

Filtered Water Supply.—Regularly every week two samples of filtered-water as delivered from the taps were examined both chemically and bacteriologically, and the results submitted to the General Committee as required under Section 243 of the Act III (B. C.) of 1899. The chemical examination showed that as regards "total solids" the amount during the dry seasons was very much higher than what it was during the rains and the subsequent months. The water was found to be free both from "nitrates" and "free ammonia" all throughout the year ; while albuminoid ammonia" averaged 0·0049 part per 100,000. The amount of "chlorine" as dissolved chlorides and of "oxygen consumed" varied from 0·5 to 2·6 parts and 0·006 to 0·018 part, respectively. While "nitrates" in the water averaged 0·020 part per 100,000. Thus chemically considered, the water may be pronounced a good potable water ; the bacteriological examination showed that the number of colonies in agar-plates kept for three days at 37° C never exceeded 100 per C. C. In none of the weekly examinations, comma bacilli nor B. typhi abdominalis, were detected, but B. coli communis were found in all the examinations. With a view to improvement in the better filtration of water in the filter beds at Pultah the Commissioners wanted to examine the water as it is filtered out and collected in the filter wells bacteriologically. The examinations are being made regularly every week, and excepting in a few instances the result of weekly examinations of the bacterial colonies showed that the 36 filter beds at Pultah were acting satisfactorily. Besides the filtered water 51 samples of Hooghli river water and 50 samples after settling were analysed as also 65 samples from tanks and wells. Excepting three, the tanks and wells were all found to be unfit for any domestic use, so they were ordered to be filled up. Altogether 210 samples of water were examined bacteriologically, in connection with local outbreaks of cholera, and comma bacilli were detected in 7 samples of tank water. Guards were posted over these tanks to prevent the spread of the disease by the water being further used, and generally this course with disinfection of infected clothes, etc., checked the dissemination effectively.

Other Chemical and Bacteriological Work.—One hundred and seventy-seven samples of ghee 102 samples of milk, 11 of butter, 8 of flour, 8 of barley-powder, 17 of arrowroot, 8 of disinfectants, 2 of ærated water, 3 of ale, 1 of cornflour, 1 of common salt, 1 of infant's food, and 4 of a miscellaneous nature were analysed ; of these 89 samples of ghee, 77 of milk, 2 of barley-powder, 14 of arrowroot, 1 of corn-flour were found to be adulterated.

The town gas was examined as to the pressure, and it was found to be 8-10ths of an inch. The necessary apparatus for the testing of the illuminating power having been received during October, the examination was commenced in November and the illuminating power of the gas was found to average 16 candles. The gas was found to be free

from sulphuretted hydrogen. Under the present contract, all the street lamps are to be supplied with Welsbach's incandescent burners which would necessarily improve materially the illumination of the town.

13 dead rats sent by the Plague Department were examined, in 8 of these plague bacilli were found, in 2 B. Anthracis and in 3 an animal parasite somewhat like that of surra were found. 13 specimens of blood were examined for enteric fever by Widal's test, and in 4 positive reactions were obtained. Three specimens of sputum were examined, in one *plague bacilli* and in another *tubercle bacilli* were detected. In a sample of intestinal secretion from a suspected tubercular case, no tubercle bacilli were found, and a smear preparation from an enlarged gland in a suspected case of supposed *pestis ambulans* showed no plague bacilli.

The Analyst attended in Court to give evidence in prosecution cases on 66 occasions during the year. In this connection it should be recorded that an important judgment was delivered in favour of the Corporation by the Municipal Magistrate, Calcutta, in the ghee prosecution case (Corporation *vs.* Satyapriya Koch and another) in which the Corporation Analyst pronounced the ghee to be adulterated, while the Chemical Examiner to the Government of Bengal declared the same to be free from any admixture. This may be regarded as a test case, as the accused was one of the largest wholesale vendors and was defended regardless of cost.

Work done by the Sanitary Inspectors.—4,653 cases of disease were investigated, and the number of houses disinfected during the year was 3,787. In addition to these disinfections a large quantity of infected articles were destroyed ; besides articles of clothing, bedding, &c., which were passed through the Equifex Steam-Stove.

ABSTRACT OF THE REPORT OF THE MADRAS MUNICIPALITY FOR 1901-02.

(*Lieutenant-Colonel Sir G. M. J. Moore, Kt., C.I.E.; President.*)

Drainage.—The expenditure on new works amounted to £16,330, the bulk of which was incurred on the new drainage scheme. The work in laying the cast-iron main was continued during the year and 16,824 lineal feet were laid. The laying of the stoneware sewers in Hall's Parcherry, Boodhi Begum's Parcherry, and Azeez-ul-Mulk's Parcherry, in connection with the Ice House Road main, together with the house connections and sewer ventilators was commenced and completed during the year.

Sixty-three house connections and 430 ventilators were fixed in the 7th Division.

At Purasawakam a new sewer of 12-inch and 9-inch cement pipes was laid along the High Road from Vedavinoyagar Road to Saravanaperumal Covil Street—the 12-inch substituting a 9-inch sewer laid in 1896 as a temporary measure. This sewer now takes off the sewage that hitherto flowed into a tank in the latter street.

The opening out of a new street from the Wallajah Road through Chetty's Gardens to Pycroft's Road in Triplicane, and another from Waller's Road through Narasingapuram to the Napier Park is in progress. The buildings acquired through the Collector of Madras, and which are being removed, cost £3,560. Some of this outlay is being recovered by sale of material and portions of land not required. These new streets are being opened for a double purpose, one being to open up the crowded and badly arranged portions of Triplicane and Narasingapuram, and the other to give a clear line for the laying down of the main sewers of the new drainage system for this locality,

Plans, sections, and estimates are under preparation for draining the 5th Division and a portion of the 4th Division, levels having been previously taken for this purpose. Levels have been taken for similar work to be done in the 1st Division.

Sewer No. 3.—After the opening of the joint beach station on the North Beach Road, the municipality has found it very difficult to clean the sewer at the manholes which are now situated between the lines of both the Madras and South Indian Railways, and after much correspondence on this matter, the Consulting Engineer for Railways agreed to recommend that these railways pay for the construction of a new sewer outside their limits in substitution of the one now in use. The Government in their order No. 1573 Ry. of the 20th September, 1901, sanctioned the work being done at the cost of both railways, and the work was put in hand on the 27th January, 1902, and is still in progress. Much difficulty has been met with in carrying out this work, owing to the presence of the old sea wall, with its revetment, having been found on the proposed alignment of the new sewer. Up to date 471 feet of the sewer has been laid.

Water Supply.—The meters referred to in last year's report have been received and fixed in places where they were found necessary. Out of the other 12 works shown in Statement II-A, Appendix I, seven were completed, two are in progress, and the remaining three not commenced, owing to the question raised by Government regarding the grant of 1½ lakhs for plague charges being still under consideration.

During the year under report 1,019 yards of new pipes were laid and 10 fountains, one valve, 12 stop-cocks, seven hydrants, and 56 meters were fixed.

Cleaning Pipes.—From the balance available out of the grant of £8,701, which was provided for cleaning pipes 9-inch and below, £3,200 were spent during the year, and the total length of pipes taken up, cleaned, and relaid during the year was 174,594 feet. This brings the total length taken up, cleaned, and relaid since 26th September, 1900, to 281,538 feet.

On the 1st April, 1901, the level of the Red Hills Lake stood at 35·73, and on the 31st March, 1902, at 40·40. On the 2nd April, 1901, the level of the lake fell to 35·68 when pumping had to be taken in hand for the water supply of the city and was maintained up to 13th November, 1901, when the level of the lake was raised by rainfall and pumping stopped. The lowest level to which the lake fell during the year was 29·07, the level it stood at on the 25th October, 1901.

The quantity of water supplied to the city during 1901-02 was 588,280,185 cubic feet, against 534,865,815 cubic feet last year.

Private Services.—820 new services were laid by licensed plumbers during the year, and 1,610 existing services were extended. The number of new services laid, together with the total up to the end of 1900-01 makes the total of 17,124.

The quantity of water used for non-domestic purposes during the year was 106,416,865 gallons.

Births and Deaths.—The total number of births registered during the year 1901, exclusive of still-births, was 18,872, against 20,672, being 1,800 births less than the year previous, but 461 births above the mean of the decade, viz., 18,411·2. The ratio per 1,000 per annum calculated on census population of 1901 was 37·0, against 40·5. The number of births recorded during the previous year was exceptionally high. The male live-births numbered 9,555 and the female 9,317, the proportion of males to every 100 females being 102·5.

Mortality.—The year under report was a very unhealthy one, and the death-rate all through the year was above the average. The total number of deaths registered during the year was 28,031, against 20,937 of the previous year. The death-rate, calculated on the census population of 1901, was 55·0 per 1,000 per annum, against 41·1 for the year 1900 calculated on the same census population. August and September were as usual the most unhealthy months of the year when the appallingly high death-rates of 89·4 and 84·3 respectively per 1,000 per annum were recorded. It is impossible to say with any amount of accuracy, in the present state of matters in the city, what caused this very high death-rate. Cholera prevailed epidemically from the beginning of August to the middle of November, but the number of deaths returned under this head were not sufficient to account for the increased death-rate. The means at present at the disposal of the Health Officer are not sufficient to enable him to arrive at any conclusion in a matter like this. All the houses where deaths occurred were visited by the sanitary staff and inquiries made, but the lack of medical knowledge on their part, coupled with obtuseness and an overwhelming tendency on the part of the relatives to return negative answers to all questions, prevented satisfactory evidence being obtained as to the exact cause of death. Employing the few resources at disposal, the only conclusion that could be arrived at was that cholera was much more prevalent than would appear from the published figures, and would in itself account for a good part of the excess. In addition, the season appeared to be unusually unfavourable, and many deaths were attributed to fever and dysentery. The scarcity from which, in common with other parts of India, Madras suffered for the last two years, continued to lower the general vitality of the masses of the population, who were in the best of times poor, and laid them open to the ravages of all diseases and particularly of the infectious ones. There was besides a large influx of beggars and semi-starved people from the neighbouring districts where scarcity was much more severe. Many of them either could not or would not work, and either succumbed to some slight indisposition which would scarcely have been fatal to a vigorous individual or actually died of starvation.

Mortality according to Sex.—The male deaths numbered 13,988 and the females 14,043, giving a proportion of 99·6 males to every 100 females.

Mortality according to Nationality.—The deaths among Europeans were 125, among Eurasians 492, among Native Christians 1,075, among Hindus 23,272, among Mahomedans 3,066, and among others 1, the ratios being 40·3 among Christians, 56·6 among Hindus, 53·4 among Mahomedans, and 2·4 among others, against 35·7, 47·8, 43·7, and 8·4 of the previous year respectively. The proportion of males to every 100 females among Christians was 80·9, among Hindus, 101·5, and among Mahomedans 96·5.

Mortality according to Causes.—There has been a perceptible increase of deaths during the year under all the principal heads of diseases except under measles which

has decreased from 280 to 222. Deaths from fever rose from 5,898 in 1900 to 9,151 in 1901, small-pox from 46 to 292, bowel complaints from 3,408 to 4,870 from cholera, 632 to 1,242, and all other diseases from 10,669 to 12,251. Cholera was epidemic during the second half of the year, and it is probable that a large number of deaths from this cause were registered under the other heads to prevent alarm or to avoid municipal visitations.

Small-pox.—The total number of deaths registered from small-pox was 292 against 46 in the previous year and was the highest number recorded in the decennium, the ratio being 0·5 against 0·1. The usual measures were adopted to check the progress of the disease. Vaccination was vigorously pushed on, houses of the patients including bedding and clothes were promptly disinfected, and, in several cases, patients who had insufficient accommodation were sent to hospitals.

Vaccination.—The total number of cases vaccinated during the official year 1901–02 was 38,265 against 32,571 in 1900–01, the increase being due to the prevalence of small-pox in the city and to the increase in the number of emigrant coolies vaccinated during the year. The results of 38,265 vaccinations performed were 30,064 successful, 4,077 unsuccessful, and 4,124 unknown.

Of the total 34,504 cases vaccinated in the municipal vaccine depôts, 11,337 cases were brought to the depôts for inspection of results, and in 20,918 cases the results were verified by the respective divisional vaccinators. The parents and guardians who failed to comply with the byelaw 5 were warned to take their children to the depôts. In 200 cases the defaulters were prosecuted and fined to the extent of Rs. 79–12–0. The number of cases verified by the inspecting staff was 15,746 out of a total of 34,504.

The percentage of success obtained both in primary and re-vaccinations, excluding the unknown cases from the total, was 88·05 which is 3·64 per cent. below that of the year 1900–01. This decrease is due to the low percentage of success obtained in the Natal Emigration Depôt from the use of the lanoline vaccine as shown below :—

——	Total cases vaccinated.	Percentage of success.
Calf-to-Arm Vaccination	33,078	89·34
Glycerinated lymph	1,426	97·19
Lanoline lymph	3,761	72·88

Out of 38,265 cases vaccinated 21,823 were primary vaccinations, against 19,875 in 1900–01, showing an increase of 1,948 cases with ·35 per cent. of success in excess of the previous year.

During the year 15,610 children under one year of age were vaccinated, including the 66 cases which were done in the Natal Emigration Depôt, against 13,687 in 1900–01. The increase was mainly due to making up the arrears of cases pending ; the percentage of success obtained in infant vaccination was 98·94 which is ·64 less than the previous year. 10,492 of these cases were born in Madras and 5,118 were born up-country.

Small-pox was prevalent throughout the year 1901–02. There was a large number of deaths during the first half of the year and the disease showed a tendency to decline in the second half. Two temporary vaccinators were entertained from May to August 1901 to make house to house inspection. There were also cases of small-pox imported into the city from time to time. Every attempt was made to remove the patients who were insufficiently accommodated to hospitals and isolation camps. The infected houses were disinfected by the sanitary staff and the surrounding localties were visited by the vaccine staff and steps were taken to vaccinate the unprotected children. Re-vaccination was also encouraged.

Fevers.—The deaths from fevers during the year numbered 9,151 against 5,898, the ratio being 17·9 against 13·0 in the previous year. The number registered during the year is the highest ever recorded in Madras. It is impossible to say how many of these deaths were due to malaria, for it must be remembered that fever is a generic term

to the Madrassi, under which every disease attended with fever is included. But whatever the nature of these fevers there is no doubt that the heavy mortality was largely determined by the insanitary conditions which obtain in Madras, viz., overcrowded and ill-ventilated houses in undrained areas together with an insufficiency of food.

Bowel-complaints.—The mortality from dysentery and diarrhœa was 4,099 and 771 respectively against 2,842 and 566 in the previous year. The increase of deaths under these two diseases have been a usual accompaniment to an epidemic of cholera. The ratio of deaths from dysentery was 8·0 per 1,000 and from diarrhœa 1·5.

Infantile Mortality.—The death-rate among infants under one year of age was 328·3 per 1,000 births against 272·0 of the previous year, but the ratio calculated on the total infantile population of 1901 census was 454·0 against 411·5. The scarcity which was prevailing in the city was probably one of the causes of this increase.

Meteorological Conditions.—The following is taken from the report of the Government astronomer :—Temperature was above the average for every month except December when it was 0·2° F. below ; the highest shade temperature was 108·5° F. on the 4th June, and the lowest 59·5° F. on the 26th November. The excess of the mean temperature was greatest in February, and it averaged 3·7° F. " Humidity was below the average for March, equal to the average for May and June, and above the average for all other months. Humidity was lowest on the 23rd May when it averaged 31." " Rainfall was below the average for January, March, April, May, June, September and October, and above the average for the remaining months. The deficiency was greatest for May (2·06 inches) and the excess was greatest for December for which month it was 8·87 inches. The rainfall for the year was 10·82 inches above the average, the total fall being 59·84 inches."

Cholera.—In the year 1900 cholera was epidemic in Madras from the beginning of August to the middle of November. The disease, however, never entirely disappeared from the city throughout the year. Sporadic cases continued to occur in November and December, and in the latter month alone 31 deaths were reported from all parts of the city. It is interesting to compare the course of the cholera outbreak in the city in the last two years. The disease ran identically the same course almost in every detail. The disease was prevalent throughout the year in both the years and assumed epidemic proportions from August to November—but the epidemic of 1901 spread over a much wider area, and consequently the number of attacks and deaths were very nearly double that of the previous year. The next noticeable feature of the two outbreaks is that the greatest number of attacks occurred exactly at the same period of the year almost to a day, namely, from the 16th August to 20th September. It more than ever proves the close relationship the epidemic bears to seasonal influences. In another part of this report reference was made as to the causes of increased mortality of the year. Every one of those causes operated favourably to the outbreak and spread of the disease.

In common with the city all the neighbouring villages also suffered from cholera. It has always been a point of discussion whether these villages were the means of introducing cholera into the city or *vice versâ*. Suffice it to say that the relation between the two is so intimate that one cannot have an epidemic outbreak with the other escaping. The residents of neighbouring villages—practically all of them—find their work in the city. Any measure, therefore, for the prevention of an epidemic in the city would be insufficient if it does not include means to prevent the spread of the same in these villages.

The total number of deaths from cholera during the year was 1,242, giving a ratio of 2·4 per 1,000 of the population. This is the highest recorded in the decennium. The epidemic was worst in the 1st Division, which includes some of the filthiest spots in the whole city. The 5th Division was the next worst centre. A very fair number of cases in this division occurred among respectable Eurasian residents.

Plague measures.—The Passport offices and prosecutions were in charge of the Plague Officer throughout the official year. Passports were issued at Perambore and Bezwada, and those issued at the latter place were checked at Washermanpet. The number of persons detained during the year at the Plague camps were 1,056 at Perambore and 11 at Washermanpet. Besides these, 82 persons were kept under observation at the Egmore Plague Hospital. Five cases of plague were treated in the Egmore Plague Hospital, two died and three recovered. All the cases were imported ones.

During the year under report the total number of passports issued at Perambore to passengers coming from infected areas was 55,120 against 48,019 of the previous year, an increase of 7,101. This increase was owing to a large number of persons leaving those places where plague was severe, such as Vaniyambadi, Ambur and Bellary. The passports dealt with by the Plague Inspection of the city, exclusive of those sent to the medical officers of hospitals, regiments, &c., were 50,171 against 45,469 in the preceding official year. The number untraced by the city passport examiners was 1,224 against 1,146 in 1900–01. The percentage of untraced passport holders was 2·44 against 2·52 of the preceding year. Besides those issued in the city, passports were also received from mofussil stations. These mofussil passport holders who were also observed in the city numbered 8,079 against 3,593 of the preceding year, showing an enormous increase of 4,486. Out of these the number of passport holders left untraced and unobserved was 516 against 365, an increase of 151, but the percentage of such untraced cases was only 6·39 against 10·16 in the preceding year, a decrease of 3·77.

The attendance of the passport holders was very satisfactory throughout the year. Amongst the 50,171 passport holders there were only 339 prosecutions and 178 convictions against 45,469 passport holders, 546 prosecutions and 302 convictions in 1900–01, and the fines inflicted amounted to Rs. 591-12-0 against Rs. 893-12-0 in the previous year.

The Port Health Officer reports as follows for the calendar year 1901 :—433 vessels, departures from Madras, carrying a crew of 36,527 men with 34,312 passengers were inspected and granted bills of health. 188 vessels, arrivals from plague infected ports, carrying a crew of 16,396 men and 4,589 passengers for Madras were inspected before any communication between the vessels and the shore was permitted, and all the passengers were given plague passports. 12,000 shore coolies who worked on board these vessels were inspected before they were sent on board and were given a disinfecting bath on their return in the evening. Some of these coolies, from sickness or other causes, were necessarily absent at times. These were traced out and inspected by the municipal staff.

ABSTRACT OF THE REPORT OF THE MUNICIPAL COMMISSIONER FOR THE CITY OF BOMBAY FOR 1901-02.

(*W. L. Harvey, Esq., C.I.E., Municipal Commissioner.*)

PUBLIC WORKS.—*Drainage.*—The machinery at the compressor station and the several ejector stations worked satisfactorily during the year.

The engines and pumps at the Love Grove pumping station worked satisfactorily. The efficiency of the pumps as tested by monthly observations taken showed an average of 89·92 per cent.

The street portions of the house drainage connections, carried out partly by contractors and partly departmentally, numbered 4,132, at a cost of £6,811.

Several latrines and urinals have been constructed at different places to meet the public convenience.

Works in connection with the sanitary arrangements of the various health camps, observation camps and plague hospitals, were carried out by the Drainage Department, Ordinary Branch. Several important works were also executed by the Drainage Department, Special and Ordinary Branches.

WATER WORKS.—*Tansa Lake.*—The rainfall for 1901 was 96·15 inches against 104·60 inches for 1900. The total quantity of water received in the lake was 35,054 millions of gallons, or 47·8 per cent. of the rainfall on the catchment area of 52·5 square miles. On the morning of the 29th November, 1901, the Tansa Duct gave way at mile 22-2530. The supply was temporarily restored on the 4th December, and water was again turned on in the duct on the 25th December, 1901. The stoppage of the supply while repairs were in progress was taken advantage of to repair the duct between Bhandup and Thana. During the year there was no burst in the 48-inch main. Most of the remaining jungle along the line of the aqueduct in the Kasheli Division has been cleared.

Vehar Lake.—The rainfall for 1901 was 75·58 inches against 72·96 inches for 1900. The total quantity of rain which fell on the whole drainage area of 3,900 acres was about 6,650 million gallons, of which about 5,053 million gallons reached the lake, or about 76 per cent. of the total rainfall. There was no burst outside Bombay on the Vehar 24-inch main, but there were two bursts near Coorla on the 32-inch main.

Tulsi Lake.—The rainfall for 1901 was 93·62 inches against 93·02 inches for 1900. The total quantity of rainfall on the whole drainage area of 1,700 acres was 3,611 million gallons, of which about 2,329 million gallons reached the lake—this forms 64·5 per cent. of the total rainfall. There were three bursts on the Tulsi line, two of which were due to the action of the scraper which was passed through the main in February, and which in addition to improving the quality of the water has increased the total delivery by about 12½ per cent.

Supply and Distribution.—A 4-inch main was laid to supply new buildings erected on the Improvement Trust Wellington Lines Estate. There were 223 bursts in several mains, 431 new connections were made and 273 connections were cut off for various reasons. The total number of connections is 20,552.

PUBLIC HEALTH.—The state of the public health during the year was better than in the preceding year, the number of deaths, exclusive of still-born, being 59,495 against 79,350 for the previous year. There were 18,736 deaths from plague against 13,285 during the preceding year. The control of plague measures was transferred to the Health Department in October 1901. The number of births registered during the year was 13,520.

The water-supply was analysed by Dr. Cayley chemically and bacteriologically every month during the year.

ABSTRACT OF THE REPORT OF THE HEALTH OFFICER OF BOMBAY CITY FOR 1901.

(*Dr. John A. Turner.*)

In reviewing the history of the health of the City during the year 1901, it is necessary to consider the hygienic aspect apart from Plague. The City of Bombay is situated on an area which formerly consisted of a group of small islands which have gradually become one by the extension of the layer by reclamation and filling in of the landlocked space of seas. The area of the island is 22·41 square miles. The configuration of the island is made up of two parallel ridges of hills, the space between forming a basin, which in parts is below the level of high water mark. This configuration must be considered in dealing with the hygienic aspects as in times of rain parts of the Island are flooded.

The dampness of the soil contributes a great factor in the health condition of a community, and every precaution should be taken to dry the soil by drainage and preventing the storm water from the high levels flooding the lower levels. Owing to this peculiar configuration much difficulty is experienced in draining the low-lying parts, but every attempt should be made to prevent further access of water by diverting all sewage and surface water directly away from houses in proper channels and cementing the surface of the ground around houses, stables and washing places.

Much interesting information is supply by the Government Meteorological Observatory. Great fluctuations are to be noticed in the rainfall in the observations taken in various parts of Bombay. Rainfall during 1901 was 75·32 inches. This was not spread all over the rainy season, but ceased earlier than usual. A large portion of this rain flows off the surface, some remains on the low-lying land, a portion percolates the soil to increase the ground water, some is used up by vegetation, while the remainder evaporates. The influences at work, which affect the health of the people, are evaporation, condensation and percolation.

Temperature, Pressure and Humidity.—The chief of these is the percolation through the soil to increase the ground water. The most unhealthy places are those in which the ground water is highest and those that are liable to fluctuations, as in addition to the ground water always present, the low-lying parts of Bombay received polluted water from the higher levels. The raising of these parts by filling in does not reduce the height of the ground water, but increases it in that locality unless provision is made for drainage before filling in. Increase in sickness during and immediately after the rains is chiefly due to the dampness of the soil and moisture of the atmosphere around dwellings; as the ground water rises after heavy rains, the polluted ground air is forced out into houses. In most of the houses of the poorer classes the floors are of mud and cowdung, and the people sleep on the ground. Diseases, of the lungs, rheumatism and malaria are the results. Improvement in the general health of a locality has always been found to follow draining of the soil

As regards the seasonal influence on diseases, the cold weather season, extending from December until March, is the period of highest mortality, the hot weather from March until June the lowest, and from June until November the period of seasonal increase in the mortality.

The low vitality of the poorer classes of Hindus renders them easily susceptible to seasonal influence. Apart from plague, which has its periodical rise in the cold weather months, diseases of the respiratory system play great havoc among the poorer classes. In the cold weather, when they are obliged to sleep indoors in an overcrowded and vitiated atmosphere, plague spreads rapidly, while the cold air easily affects them when

exposed to it, causing chill and disease of the respiratory system. The improvement in the health of the people is very noticeable when they vacate their houses for well ventilated camps.

Population.—The population of the city estimated by the census of 1901 was 776,006, and it is on this population that all the statistics except those of age-periods are based, as the information regarding the population by age-periods adopted in the last census was not available in time.

Births.—The number of births registered during the year was 13,520, being 832 more than in the previous year, and 1,656 more than the average of the preceding five years, giving a birth-rate of 17·42 per 1,000 of population.

In my report for the last year, I alluded to the difficulties in obtaining an accurate return of the births in the city. In this year's report I state what has been done to improve the system of birth and death registration. According to the census returns there were 171,122 females between the ages of 15 to 45. The proportion of males to females was 161·96 to 100. The number of births registered was, however, 832 more than last year. Of the total number of births 7,085 were males and 6,435 females; and 2,153 still-born births were registered during the year under report. Birth-rate amongst Parsees is a little higher and that amongst Europeans a little lower than in the previous year.

Mortality.—The number of deaths in the City of Bombay during 1901, exclusive of still-born, was 59,495, being 19,855 less than 1900, but 5,677 more than the average for the past five years, giving an annual death-rate of 76·66 per 1,000 of the population.

The death-rate from all causes during the past 11 years was—

Year.	Death-rate.	Year.	Death-rate.	Year.	Death-rate.
1891	29·01	1895	30·52	1899	68·07
1892	32·26	1896	40·71	1900	96·56
1893	28·16	1897	58·28	1901	76·66
1894	53·25	1898	63·23		

Plague.—During the greater part of the year, the control of all plague measures was under Government as in the previous year. In October I took over the duties of supervision in addition to my own, and the control of plague is now in the hands of the Health Department.

I will allude here briefly to the plague epidemic during 1901. The mortality from plague began its seasonal rise in December, 1900, and reached its maximum in February, 1901, and then declined. There were 21,006 attacks and 18,736 deaths from plague during the year as against 17,913 attacks and 13,285 deaths during the last year. As in previous years the general Hindu community suffered severely, the mortality amongst this class being 12,418 as against 9,030 during the last year. There was also an increase in the number of deaths from plague in all the communities except Europeans, who show 10 cases as against 11 of the last year. There was a marked reduction in the number of deaths occurring in Upper Colaba, Esplanade, Chaupati, Walkeshwar and Tarwari as compared with the last year. The increase in Mahim is, no doubt, due to the movement of the population there.

A total of 12,611 deaths from plague occurred amongst males and 6,125 amongst females. The age-period of males was from 14 to 44 years and amongst females from 10 to 34 years, the highest mortality occurred.

The highest total mortality was recorded in the month of March, the number being 4,697, February coming next with 3,850 deaths; the lowest mortality was in June, 312 deaths being recorded. From June the mortality rose gradually to the end of the year, 732 deaths being recorded in December. The plague mortality was highest on the 26th February, 214 deaths being registered, while on the 25th February the highest daily mortality for the year was recorded, viz., 409.

The measures adopted for controlling plague were the provision of camps for those willing to evacuate plague-stricken houses, disinfection by washing the rooms with

perchloride of mercury and phenyle and fumigation with sulphur. Compulsory removal to hospital was not enforced. The disease was of a very virulent type, the mortality in hospitals varying from 79 to 91 per cent.

After all has been said and written, about plague, it will not be necessary for me to enter into the subject. I must, however, mention that from the experience gained during the past years in preventive treatment of this disease the overcrowding, poverty and insanitary condition contribute largely to its spread. Nothing can be more evident than that fresh air, sunlight and improved sanitary surroundings are antagonistic to the spread of the disease. Over 13,000 persons were received in the municipal camps during the plague epidemic of 1901. The percentage of deaths in these camps was 0·56. About 25,000 people removed of their own accord into the private camps on the sea-face and in the north of the island.

Causes of Deaths compared.—In the following table it will be observed that there has been a marked decrease in the number of deaths from all diseases except plague, which stood highest amongst them when compared with the figures of the previous year.

TABLE SHOWING THE NUMBER OF DEATHS AND THE DEATH-RATE FROM DIFFERENT CAUSES IN 1900 AND 1901.

Cause of Death.	1900.		1901.	
	Number of Deaths.	Death-rate per 1,000 of Population according to the Census of 1891.	Number of Deaths.	Death-rate per 1,000 of Population according to the Census of 1901.
Small-pox	3,018	3·67	159	·20
Measles	1,500	1·82	67	·08
Fevers	7,928	9·64	7,921	10·20
Cholera	4,273	5·19	198	·25
Plague	13,285	16·16	18,736	24·14
Phthisis	8,199	9·97	6,516	8·39
Diseases of the Nervous System	4,328	5·26	2,971	3·82
„ Respiratory System	12,522	15·23	7,804	10·05
Diarrhœa	5,850	7·11	2,375	3·06
Dysentery	2,826	3·45	1,341	1·72
Accidents	1,072	1·30	764	·98
All other Causes except Still-born	14,549	17·70	10,643	13·71
Total	79,350	96·56	59,495	76·66

By sexes, 35,504 males and 23,991 females died during the year. Excluding those under five years, the highest number of deaths amongst males occurred in the age-period between 25 and 29 years, 4,286 deaths having been registered; and amongst females 3,145 in the age-period of 60 and over.

Amongst persons born in Bombay, 13,064 deaths were registered during the year and amongst those born outside of Bombay, 44,355. The places of birth of 2,076 persons could not be ascertained.

The Death-rate by Caste.—The Jain community, which includes Banias, excepting Negro-Africans, Buddhists and Lingaets, who form very small communities, show the highest mortality, viz., 152·86 per 1,000 of population. Next comes Hindus, low-caste, the death-rate being 87·56. The general mass of the Hindu community give a death-rate of 85·42, and Mussalman, 71·43. The death-rate amongst Parsis was 30·54, European death-rate being much lower than the last year.

Small-pox.—From small-pox 159 deaths occurred during the year, as compared with 3,018 in 1900. The disease did not assume an epidemic form.

Cholera—From cholera 198 deaths were registered during the year as compared with 4,273 deaths in 1900. The disease did not assume an epidemic form. The highest number of deaths from this disease was registered in the month of August. Of the total number of deaths 131 occurred amongst Hindus of other caste, and 28 amongst Hindus, low-caste, and 18 amongst Mussulmans. A total of 36 deaths occurred amongst persons who had resided in Bombay for three months and under, and 21 deaths amongst those who resided in Bombay for six months and under. The greater number of deaths occurred in persons born outside of Bombay.

Fevers.—A total of 7,921 deaths was registered from fevers. Remittent fever claims the highest number, *viz.*, 7,266, being 12 less than last year, and 1,476 more than the average of the previous five years. To simple continued fever 113 deaths were ascribed, being 68 more than last year, and 368 less than the average of the previous five years. To enteric fever 62 deaths were registered, being two more than the last year and 20 more than the average of the last five years. To ague 480 deaths were ascribed, being 65 less than the last year, and 227 more than the average of the last five years. Out of the large number of deaths returned as due to remittent fever many may have been due to relapsing fever and plague, as it is very difficult to diagnose the disease without strict examination being held in each case. It will be observed that the fever rose and fell with the mortality from plague. It rose from January to March, when 1,310 deaths were registered. The highest number of plague deaths registered in the month of March was 4,697. From the month of April fevers gradually decreased till the end of the year.

Excluding Jains, which form a very small community, there was a slight increase amongst the Hindus of other castes, the rate being 13·42 as against 10·10 in the previous year. A great decrease is noticeable amongst Hindu low-castes, the rate being 9·57 as against 22·18 in the previous year. Mussulmans gives a death-rate of 6·60 as against 9·17 of the previous year.

To relapsing fever 1,560 deaths were due, being 466 more than in the previous year. The highest number of deaths from relapsing fever were registered in the month of May, when 220 deaths were registered. From October the disease decreased gradually till the end of the year.

Measles.—Sixty-seven deaths were registered from this disease, being 1,433 less than in the last year and 777 less than the average of the preceding five years. The disease was of a mild type.

Phthisis.—6,516 deaths were reported as due to phthisis, being 1,683 less than in the previous year. Other diseases of the respiratory system amount to 7,804 deaths under the heading of bronchitis, pneumonia, pleurisy, &c.

There were 3,161 deaths amongst males and 3,355 amongst females due to phthisis. The most fatal periods of life amongst males and females were between the ages of 30 to 34. The female death-rate was nearly double that of male. Leaving out Negro-Africans, which is a small and fluctuating community, the mortality from this disease was high amongst Jains, even higher than the last year, but this is due to the fact that the Jain population, by the census of 1901, has decreased from 25,225 to 14,248. There is a decrease in the number of deaths amongst Mussulmans, the rate being 13·89 against 17·78 in the last year. Fort North shows a death-rate higher than all the other sections

Infant Mortality.—The number of children under one year of age dying during the year was 7,768, being 5,724 less than in the previous year. According to the census population of 1901, the number of children under one year of age is 9,930, whereas according to the census of 1891 it was 25,291. If these figures remain good, then the mortality of children under one year of age, calculated on that basis, would be 782·27 per 1,000 of infants under one year of age. The number of births registered during the year was 13,520, giving an infant mortality of 574·5 per 1,000 of the births.

The system of registration of births was not satisfactory. Hitherto the system adopted was by employing birth Karkoons to visit houses in different sections and to inquire into the births. This system naturally failed to obtain accurate results. I published the section of the Act and also had it circulated throughout the city explaining that all parents or persons in charge are so liable to give information of any birth subject to a penalty. The new ten dispensaries are registration offices, and notice to that effect

has been well published. More information has already been gained, and when the people become familiar with the system we shall be in a position to ascertain all births occurring in the city. It may be necessary to bring the section of the Act into force and prosecute parents who do not register the births.

General.—From diseases of the digestive system 4,872 deaths were registered, being 5,632 less than in the previous year, and 815 less than the average. Diarrhœa, dysentery and other diseases of the digestive system show a great decrease both against last year and on the average. To diseases of the nervous system 2,971 deaths were registered, being 1,357 less than the last year, but 105 more than the average. 7,804 deaths were ascribed to diseases of the respiratory system, being 4,718 less than in the last year, and 753 less than the average. To diseases of the circulatory system 297 deaths were registered, being 51 less than in the last year, and 5 less than the average.

APPENDIX.

No. 1.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner with the Government of India for 1901.

The mean temperature of 1901 was higher, and the mean rainfall nearly four inches less, than usual. The year was, on the whole, healthier than its predecessor.

2. The average strength of the European Army of India, 60,838, was almost the same as in the previous year, exceeding it by only 285. As usual, the chief causes of admission into hospital were *ague* and *venereal diseases*. The admission-rate of 27, per thousand of strength, from ague was exactly the same as that recorded for the previous year; whilst the admission-rate from venereal diseases fell from 26 to 25. The chief causes of death were, as usual, *enteric fever* and *hepatic abscess*, the former accounting for 27 per cent. and the latter 11 per cent. of all the deaths. The percentage of deaths due to enteric fever, which had been 40 in 1899, fell to 33 in the following year, and has now in the year under report, fallen to 27. The percentage of deaths attributed to hepatic abscess shows little variation: it is the same as that recorded in the preceding year, and somewhat higher than in 1899, when it was 10 per cent. As a cause of invaliding, *secondary syphilis* has ceased to take the first place and is now replaced therein by ague; but the three chief causes of invaliding were, as in the previous year, *ague*, *secondary syphilis*, and *debility*. Between them, these three were accountable for 1,062 invalidings out of a total for the year of 2,393. It is only under the head of invaliding that the returns compare unfavourably with those of 1900. The average strength of the European Army remaining practically the same in both years, the numbers invalided rose from 2,026 in 1900 to 2,393 in the year under report. Under the other heads the returns yield very favourable results. Quoting from the Army Medical Department Report: "The health of the troops was exceptionally good; the admission ratio was lower than that for any of the preceding twenty years, and not since 1883 have the death and constantly sick rates been less."

3. Estimates of the comparative healthiness of the different districts and stations, based on returns of sickness and mortality amongst troops frequently changing from one part of the country to another, are liable to be misleading. As remarked in a previous Memorandum, the special conditions affecting the troops garrisoning the several stations cannot be left out of count. If judged by its returns of sickness alone, a station with a garrison composed largely of young soldiers recently arrived in the country, or of soldiers whose health had suffered from exposure on field service or in camp during epidemics, might acquire a reputation for unhealthiness which it did not deserve. An example may be given in illustration of this from the medical history of the year under report: "Dagshai, which showed a remarkable decrease in 1900 after extensive sanitary improvements and the introduction of a piped water supply in 1899, had an admission ratio of 1103·1 per thousand, an increase of 516·6 compared with 1900 and 44·6 above the decennial average. This increase was largely due to malarial fevers amongst the men of the Essex Regiment, who had just returned from a tour of service in Burma; diseases of the digestive system, skin affections and local injuries were also prevalent, and there were 11 cases of enteric fever with five deaths, compared with six cases and two deaths in 1900 and 19 cases and three deaths in 1899." Judged by its statistics of sickness and mortality, taken by themselves and without explanation, Dugshai would thus be made to appear to have relapsed into a more unhealthy condition than before it underwent the extensive sanitary improvements, and was provided with the piped water supply, mentioned in the report.

4. There was a marked increase in the number of admissions from *influenza* during the year; but this increase was not accompanied by a corresponding increase in the mortality due to it. In the previous year the admissions due to this disease numbered 237 with one death; and during the year under report, 539 with, likewise, only one death.

5. Accompanying the disease of *cholera* mortality amongst the general population by more than 67 per cent., as compared with that recorded in the previous year, the number of deaths from this disease in the European Army of India fell from 88 in 1900 to only 12 in the year under report. The correspondence between the rise and fall of cholera prevalent amongst the native population and its rise and fall amongst the European troops stationed in the midst of that population, is only what might be expected. In last year's Memorandum it was noted that during the years 1898 and 1899, when cholera was in remarkable abeyance throughout India, the mortality due to it in the European Army underwent a corresponding decrease. In the former of these two years only 14 deaths were caused by cholera amongst the European troops, and in the latter only a single death. When, in the following year 1900, cholera again broke out amongst the general population with unprecedented violence, the deaths caused by it amongst European soldiers rose from a single death in 1899, to 88; and now again, with the abatement of the epidemic of 1900, the number of deaths of European soldiers due to cholera falls in the year under report to 12. Since, therefore, the prevalence of cholera amongst the European troops in India is seen to be intimately connected with its prevalence amongst

the people of the country, it would appear to follow that no sanitary measures devised for the prevention of the disease amongst the troops can be regarded as likely to prove completely successful, which are not at the same time calculated to prevent, or lessen, its prevalence amongst the native population. The tendency of further research into the etiology of cholera would seem to unsettle rather than to confirm the belief that the comma bacillus is the one and undoubted exciting cause of the disease. Assuming that cholera is "solely a water-borne" disease, one of the chief difficulties, according to the Sanitary Commissioner, with regard to suspected water examined, is the rarity of finding the true microbe, and the frequency of finding microbes like it. With regard to these latter cholera-like microbes, doubts are entertained as to whether they are dangerous, and whether they may not be a stage in the existence of the true comma. In some of our Memoranda we have expressed doubts as to the utility of treating wells with permanganate of potassium during cholera outbreaks, and have more than once suggested that the question should be made the subject of exact scientific investigation with the object of settling it definitely. In the report of the Sanitary Commissioner with the Government of India we find the subject dealt with as follows :—"The use of potassium permanganate for the disinfection of wells has, as usual, been frequently resorted to during the year; but though opinion on the whole is favourable, there is no proof of its efficacy; and it may be mentioned that recent experiments tend to throw discredit on present means of water purification."

6. Although the number of admissions from *small-pox* decreased from 36 in the previous year to 20 in the year under report, the number of deaths, three, remained the same in both years. At Jubbulpore there were three admissions from small-pox and two deaths; and regarding the three cases it is stated in the Army Medical Department Report that "all bore satisfactory marks of vaccination, and one of the fatal cases had been re-vaccinated in four places only a few weeks before, he contracted the disease." All of the three men were non-commissioned officers, whose duties brought them into daily contact with the native population, amongst which small-pox was prevailing. All of the other 17 men attacked, including the man who died, are said to have borne vaccination marks. It would, however, appear that, in the case of at least one of those 17, the marks were not satisfactory, for we read :—"A confluent form of the disease occurred at Rangoon in the person of a man who had not been vaccinated for 11 years and had not satisfactory marks of protection." If the three cases which occurred at Jubbulpore and of which two proved fatal, were as fully protected by vaccination as the description given of them would seem to imply, they must be regarded as instances, fortunately exceedingly rare, of the impotence of vaccination to protect against attack and death from small-pox.

7. It might have been expected that, accompanying a drier year, there would have been a marked reduction in the sickness from *malarial fevers*. The admissions from intermittent fever show, however, only a decrease of from 18,679 in the preceding year to 17,836 in the year under review. But, judging from the resulting mortality, the attacks would appear to have been less severe; for whilst 40 deaths were recorded under the head of intermittent fever in 1900, the number fell to 22 in 1901. The continued high rate of admissions during the year under report is stated to have been "owing to the fact that most of the hill stations had many more admissions than usual, due to the men sent up for change from the plains being already saturated with malaria, so that it required only chill and damp as exciting causes to light up the fever." It is perhaps yet too soon to expect any substantial decrease in the prevalence of malarial fevers amongst the troops as a result of the active measures being taken for the destruction of infection-bearing mosquitos. The final test of the success, or failure, of these measures will be their effect on the prevalence of malarial fever, and this the records kept of the disease should accurately determine.

8. *Enteric fever* continues to be the disease which occupies the place of chief interest in these annual reports. Whilst the health history of the European Army of India for the year is disposed of in 31 pages, no fewer than 18 of these are devoted to an account of enteric fever. It is gratifying to find that the decrease in the severity of the disease in the European Army of India, which was so marked a feature of the medical history of the previous year, still continues. Going no farther back than 1898, when the death-rate recorded from enteric fever was 10·17 per thousand of strength, we find that this fell in the following year to 5·14, and in 1900 to 4·77. The decrease has continued during the year under review, which returns an enteric fever death-rate of only 3·32. With the cessation of the lessened influx of drafts from England, one of the chief causes to which during the last two years the remarkable decrease in the fatality of enteric fever was generally ascribed, it remains to be seen if the disease will tend to regain its former prevalence. The Sanitary Commissioner supplies, as usual, an excellent *résumé* of the latest additions to the literature of enteric fever. Confidence in some of the cherished theories and beliefs hitherto entertained regarding the causation of the disease would seem likely to be disturbed by recent investigations. It has been found more difficult than ever to recover the specific microbe from suspected water, the progress of knowledge having led investigators to be less easily satisfied in the matter of identification. In fact, Sims Woodhead, agreeing with others as to the difficulty of finding the bacillus in water, states that he has never succeeded in isolating it therefrom, "except when he had previously placed it there himself." Yet, it is believed to be usual in India to forward samples of water for examination, and to expect the bacteriologist to state definitely whether the specific bacillus exists, or does not exist, therein. Quoting from the Report on the Progress of Hygiene for 1901-02, by Major Firth, Professor of Military Hygiene in the Medical Staff College, London :—"As regards the risks attending overcrowding in tents, and the evils resulting from food pollution by means of dust and flies, a most valuable mass of evidence has been published by the United States Government in the form of an Abstract of Report on the Typhoid Fever Epidemics in the Volunteer Camps of the United States Army in 1898. Many of the conclusions formed by the Commission who drew up the report are of great suggestiveness and importance. They found that in the majority of cases, infected water was not an important factor in the spread of the enteric fever, but that there was much to indicate the necessity of extraordinary measures for the prevention of direct infection from man to man, and of infection through soil and from the clothing, bedding, and tentage of the

troops." Among other questions that have recently been asked, is the one as to whether enteric fever can be caused only by the bacillus of Eberth, or whether infection by other bacilli may not give rise to fevers indistinguishable from it both chemically and pathologically. But the Report of the Sanitary Commissioner with the Government of India, and that of Professor Firth above referred to, will have to be consulted by those who wish for fuller information regarding recent research into the "nature or entity of enteric fever and its etiology."

9. For the year under report a further decrease in the prevalence of *venereal diseases* in the European Army of India has to be recorded. Ever since the year 1895, when the admission-rate attained the enormous ratio of 522·3, per thousand of strength, there has been a continual decrease year by year until now, in 1901, the ratio has fallen to 276·0. During the preceding year it was 298·1. The lessened influx of drafts of young soldiers from England during the last two years may have contributed to diminished prevalence of these diseases, as it has undoubtedly done to diminished prevalence of enteric fever. Now that the annual despatch of drafts of young soldiers from England to India has been resumed, it is possible that the returns may in future show a check in the steady decrease from year to year in the number of men suffering from these complaints. But apart from whatever influence age, and length of residence in the country may have in strengthening the soldier's self-control and enabling him more fully to realize the disastrous consequences likely to follow his giving way to temptation, it is evident that strenuous efforts are being made, especially by the medical and regimental officers, as well as by chaplains, to safeguard the men under their charge from the dangers to which they are so constantly exposed in most Indian stations. "Lectures and warnings were frequently addressed by medical officers, chaplains, and regimental officers; means of ablution were provided and their use encouraged; measures were taken to prevent the women being in evidence or soliciting the men; dangerous places were placed out of bounds; concerts and other evening amusements were provided."

10. The strength of the *Native Army*, 122,806, remained nearly the same as during the preceding year, when it was greater by only 657. There was a marked decrease in the death-rate from 14·04, per thousand of strength, to 10·68, or to slightly below that recorded for 1899. This decrease was due to lessened mortality from nearly all the chief diseases, but especially from *cholera*. From this last disease 388 deaths were recorded in the preceding year, and only 19 during the year under report. The decrease in the cholera mortality was synchronous with its decrease amongst the general population. Some attempt is made to account for the outbreaks of cholera in the case of four of the regiments attacked. In one of these regiments unsound fruit is said to have caused the outbreak; and it is added that as soon as fruit was forbidden no more cases occurred. "As to the other regiments affected, the only point mentioned, when anything is said at all, is the presence of the disease in the neighbourhood." From the nature of these statements it may be inferred that the observations of another year have done little to dispel the obscurity in which the origin of cholera outbreaks is still usually found to be involved.

11. In spite of the admissions from *influenza* having risen from 114 in the previous year to 1,232 in the year under report, the number of deaths caused by it was only three, as compared with four in the former year. The type of disease would thus appear to have been mild. As usual, *ague* was the chief cause of sickness in the Native Army: it was accountable for upwards of 43 per cent. of all the admissions into hoposital, and for a total of 120 deaths. But *remittent fever*, although the cause of a percentage of only 1·72 admissions, was yet accountable for 154 deaths. This year, again, *pneumonia* takes the first place as a cause of mortality in the Native Army, although the number of deaths due to it decreased to 334 from 410 in the previous year. "The admission-rate from *enteric fever* was only half as high as in the preceding year, and the death-rate was also diminished. The ratios for native troops and prisoners are very unlike those for European troops. The statistics do not yet reflect the opinion, so prominent of late, that enteric fever is quite common among natives; and so long as medical officers return few cases, the statistical tables cannot show many. As a matter of fact, in spite of the way in which the attention of the medical officers has been called to the possibilities, the number of cases and the ratio were lower than in seven out of the ten years preceding and below the averages." The opinion that enteric fever is more prevalent among natives of India than has hitherto been supposed, appears to have gained adherents by frequent repetition. An attempt has been made to explain the comparative immunity of adult natives, such as those who are found in the ranks of the Native Army, and those who constitute the bulk of the prisoners in Indian jails, by the hypothesis that natives have mostly had enteric fever when children, and have thus been rendered insusceptible of further attack. Apart from the absence of any reliable record of facts which would support such a hypothesis, Brault concludes, from testings of the blood of Arab children, that "no support is lent to the view that adult immunity depends upon a prevalence of the disease in childhood." Whilst *tubercle of the lungs*, *plague*, *and cerebro-spinal fever* were all more prevalent and fatal in the year under report than in the previons year, the mortality from *dysentery* and *diarrhœa*, greatly diminished. The number of deaths from the last mentioned two diseases was 58 as compared with 114 in 1900.

12. The ratio of admissions from *veneral diseases* in the Native Army, which had increased to 42·5 per thousand of strength in the preceeding year, again fell to 34·3, or to almost exactly the same as that recorded in 1899. The increase in 1900 was ascribed, in some parts of India, to the number of destitute women who, under pressure of famine, resorted to prostitution. The reversion of the sick-rate from these diseases to normal, on the disappearance of famine, would seem to lend support to this explanation.

13. Accompanying the disappearance of famine from most parts of the country, and the return of more prosperous times, there was a marked decrease in strength of the *Jail* population of India from an average of 121,812 in the previous year to 117,203 during the year under report. The health of the prisoners, like that of the general population, improved; and although the admission-rate was nearly the same in both years, the death-rate decreased to 26·5 from 34·2 in 1900. As usual, *bowel*

complaints, pneumonia and *tubercle of the lungs* were the chief causes of death. Between them, dysentery and diarrhœa were accountable for 26·8 per cent., and pneumonia and tubercle of the lungs together, for 27·8 per cent. of the total jail mortality. The remark made by the Sanitary Commissioner with the Government of India in his Report for 1900, still holds good for the year under report. "The heads of jail mortality requiring special attention are bowel complaints, tubercle of the lungs and respiratory diseases." As was only to be expected, the abatement of the destructive epidemic of *cholera* which prevailed amongst the general population of India during the preceding year was accompanied by a fall in the death-rate from that disease in jails. This rate which had been 2·23 in 1900, fell to ·90 in the year under report. It might be supposed that in a jail, if anywhere, it would be possible to ascertain the precise means by which the inmates became infected by cholera; but, as a matter of fact, the experience recorded in the case of the three central and five district jails attacked by cholera in the Madras Presidency during the year, is the ordinary one. "The exact manner of introduction into jails was not traced in any case, though flies, rise of subsoil water,and disturbance of cholera-burial-ground soil are mentioned in connection with causation." There is, however, an exception to this common experience reported from Burma. "An epidemic of 20 cases of cholera with 12 deaths in the Insein Central Prison was referred to infected tobacco introduced by a prisoner sent in from a police lock-up without any intimation that he had for some time been in contact with cholera cases." It is not stated if the *comma baccillus* was discovered in this case.

14. From *enteric fever* there were 41 admissions, with 20 deaths, recorded during the year. The conditions existing in jails are such as might be expected to afford facilities for accurate observation of cases from their inception to their termination in recovery or death. In the latter event, the correctness of the diagnosis could, probably in all cases, be checked by a *post mortem* examination. The death-rate recorded from enteric fever, per thousand of average strength, was ·17 amongst prisoners in jail, ·12 in the Native Army, and 3·32 in the European Army of India.

15. There was a serious increase in the prevalence of *cerebro-spinal fever* in the jails of India during the year; the number of deaths increasing from 79 in the previous year to 102. Taking into account the widespread prevalence of *plague* amongst the general population, 36 deaths from the disease in a jail population of greatly more than a hundred thousand, cannot be considered excessive.

14th October, 1903.

No. 2.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Bengal for 1901.

As measured by its record of vital statistics, the year 1901 was not so unhealthy as its predecessor. Whilst the birth-rate was higher, the death-rate was lower than in 1900. Yet, although less than in the previous year, the death-rate was somewhat in excess of the average of the last five years. The rainfall was generally in defect and unevenly distributed. "The late commencement of the monsoon and its early cessation affected the agricultural out-turn, which was lower in almost all the districts." Such conditions would unfavourably influence the public health; and, as remarked in the Government review of the report, are to some extent reflected in the vital statistics of the year. Those who maintain that an increasing population is conclusive proof of increasing prosperity should be satisfied that the prosperity of the province of Bengal has undergone no diminution during the past ten years. Notwithstanding the destructive effects of famine, cholera, and plague, the population numbers of the year under report exceed those of 1891 by not far short of three and a half millions.

2. The *birth-rate* recorded for 1901 was 38·57 per thousand of population. But for the great unhealthiness of the preceding year and the high prices of food grains which prevailed in many districts during that year, it would doubtless have been much higher. In 1899, a birth-rate of 42·96 was recorded. These figures may be taken as an indication of the very great improvement in the registration of vital statistics which has been effected in this province within the past ten years. Prior to 1892 the registration of births in Bengal was limited to municipalities; but was in that year extended to the same area as the registration of deaths. The ratio of births recorded for 1892 was only 28·1 per thousand of population for the province as a whole. Even now, complete accuracy cannot be claimed for the registration of births; but, as the result of the inquiries made by the vaccination staff in towns and villages regarding upwards of half a million of births and deaths, it was ascertained that only a percentage of 1·2 of the former and ·98 of the latter had not been recorded.

3. The fall in the *death-rate* below that for the preceding year was chiefly due to the abatement of the epidemic of cholera which prevailed with unprecedented severity during 1900. The provincial death-rate for the year under report was 31·04 as compared with 34·98 in 1900; cholera accounting for only 1·48 of the former rate against 4·64 of the latter. "As usual," writes the Sanitary Commissioner, "the mortality from cholera, dysentery, and diarrhœa and other causes was much larger in towns than in rural areas, while fever continued to prevail with greater severity in rural areas." Such would be the conclusion to which the statistics of mortality would lead; but, as

suggested in previous *Memoranda*, it appears probable that in towns the diagnosis of disease is somewhat more intelligently effected than in rural areas, with the result that a proportion of the deaths lumped together under the head of "fever" in rural circles is distributed in town circles under the heads of the several diseases to which they were really due. In the Government review of the report a similar explanation is suggested of the record of a greater number of deaths from dysentery and diarrhœa in towns than in the country.

4. *Chief Diseases.—Cholera*, which was in marked abeyance in Bengal, as in the rest of the Indian Empire, during 1898, increased in prevalence in the following year, and culminated during 1900 in the most destructive epidemic on record. During the year under report it again subsided within its ordinary limits, accounting for only 110,753 deaths as compared with 345,878 in the previous year. The cause, or causes, of these fluctuations are still far from being clearly understood. If, in accordance with general belief, cholera infection is "water-borne," an examination of the water-supply might be expected to yield some explanation of the fact that, whilst in 1898 only 65,020 people died of the disease in Bengal, this number was five times greater in 1900, and fell again in the year under report to 110,753. The Sanitary Commissioner deals with the question of the influence of the water-supply on cholera mortality at some length. "The severe prevalence of the disease throughout Orissa," he says, "appears to have been due to the short rainfall during 1901, which led to serious pollution of the drinking water-supply." It is presumed that by pollution is meant infection with the specific cholera poison, although it is not stated how this arose. The deficient rainfall is, on the other hand, supposed to have had ultimately an opposite effect in some parts of the province. The explanation is ingenious, and not inconsistent with that already quoted. "The deficient rainfall of the previous year left most of the tanks only partially replenished, and the early cessation of the rains compelled the people in many instances to use the water up to save their withering crops. Thus, the close of the year 1900 saw most of their tanks all but dry, and the scanty rainfall during the early months of this year led to their being quickly dried up, or rendered wholly useless as a source of water-supply. The people were thus prevented from obtaining their water-supply from these filthy tanks and ditches, and in this respect the scanty rainfall during the earlier months of 1901 seems to have been a blessing in disguise." In many districts disinfection of wells by permanganate of potash was carried out with what are said to have been "good results." In some places the people were eager to disinfect suspected wells, whilst in many others the measure was strongly objected to. Hitherto, the disinfection of wells with permanganate of potash has not been conducted with the scientific precision necessary to arrive at a decisive conclusion regarding its value. Most frequently, hospital assistants, vaccinators, and other persons untrained in scientific methods and unaccustomed to the exact observation and record of facts, have been those chiefly entrusted with carrying out the disinfection of the water supplies; and it is mostly on the evidence of such agents that the estimate of the usefulness of the permanganate as a disinfectant of water contaminated with the cholera poison is based. Perhaps nowhere could an experiment to test the value of the permanganate as a disinfectant of drinking water be carried out under conditions less liable to error than in a prison. In the month of August of the year under report, a severe epidemic of cholera commenced in the Central Prison at Lucknow, and caused 27 deaths. Regarding this outbreak, Major Mactaggart, Inspector-General of Prisons, writes:—"As I have mentioned when dealing with the health of the Lucknow Central Prison, there was nothing to show how the disease was introduced into this jail, but as cholera was severely epidemic in Lucknow City and in the villages surrounding the jail, it is not surprising that the jail was ultimately affected, either through the medium of flies, or in some other ways which we have been unable to trace. The wells in the jail were constantly treated before and during the outbreak with permanganate of potash, and after the first two or three cases the drinking water of the prisoners was boiled; but neither permanganating the wells as carefully as it could be done, nor boiling the water, had apparently the smallest effect on the epidemic. The move into camp appeared to lessen the number of cases, but it was not immediately successful in checking the disease." It will be allowed that the facts thus carefully observed and recorded, under circumstances to exclude error, carry more weight than the reports and opinions of the class of persons ordinarily deputed to disinfect wells during cholera epidemics. This year, again, the inoculation of emigrant coolies against cholera seems to have yielded satisfactory results. "From a summary it appears that, out of 275 uninoculated coolies, 21, or 8·36 per cent., got cholera, 10 of the cases ending fatally; while out of 414 inoculated coolies, only five, or 1·2 per cent., got the disease, but none died from it." If these figures may be accepted as the normal measure of protection conferred by anti-cholera inoculation, it would obviously be in the interests of the coolies and of those concerned with their conveyance from the place of their recruitment to their destination in Assam, that all of them should, before commencing their journey, undergo inoculation.

5. The most severe epidemic of small-pox which has visited the province within the period for which reliable statistics are available, carried off 37,680 persons during 1901. In the district in which it proved most destructive to life the disease is said to have been spread by small-pox inoculation. Since it has been established beyond question that vaccination is as effectual a protection against small-pox as inocculation, and since vaccination is without danger either to the individual upon whom it is practised or to those about him, whilst inoculation is, on the contrary, not only full of risk to the life of the person inoculated, but is a source of danger to his neighbours; the suppression of the latter method of conferring protection against small-pox, so soon as vaccination is placed within the reach of all, would appear to be unattended with either injustice or hardship to anyone. The only sufferers would be the inoculators, whose means of livelihood would be interfered with; and even these might be deprived of a grievance by being entertained as vaccinators. The suppression of inoculation would however exercise but a very limited effect on the prevalence of small-pox in a densely peopled country from some parts of which small-pox disease is probably never entirely absent. The only effectual means of putting an end to destructive small-pox epidemics are the general and efficient protection of the inhabitants by vaccination and revaccination. There was a large increase of the numbers vaccinated during the year. Such increase nearly always takes place during, and as the consequence of, the prevalence of small-pox in epidemic form. But it

is only necessary to place the number of children of less than one year of age who were successfully vaccinated beside the number of the same age available for vaccination, to realise the extent to which vaccination falls short of fully protecting the infant population of the province against small-pox. During the 12 months of the calendar year 2,870,806 births were registered, and 519,630 deaths of children under one year of age, leaving 2,351,176 available for vaccination; whilst during the 12 months of the vaccination year, 733,253 children under one year of age were successfully vaccinated. Small as the latter number may appear as compared with the number of children born, it exceeds the previous year's number by no less than 143,877, and is indicative of decided progress. The work of the Department has been seriously hindered by the constant deputation of members of the vaccination staff for employment on plague duty, or other special work.

6. *Plague* increased rapidly during the year, the deaths due to it rising from 30,134 in the previous year to 70,746, exclusive of those which took place in Calcutta. The Sanitary Commissioner strongly advocates inoculation as an efficient preventive measure against the spread of the disease. It is not claimed for inoculation that it is an absolute protection against plague, a certain proportion of the inoculated subsequently contracting the disease; but even were it as complete a protection against plague as vaccination is against small-pox, it may be questioned if it would be feasible to provide the amount of serum required for the inoculation of more than a fraction of a population so enormous as that of Bengal. The staff of trained medical officers required to carry on the work of inoculation would also be very large; and even were a sufficient quantity of serum procurable, as well as a sufficient staff of medical officers to apply it, there would still remain the uncertain temper of the people to be reckoned with. Fortunately "the people in rural areas now understand the value of "evacuation of infected houses, and readily resort to it." On the appearance of plague in a Himalayan district, the inhabitants have been accustomed from time immemorial to evacuate their villages as the readiest and most effectual means of bringing the outbreak to an end. When thoroughly carried out, evacuation of infected villages would seem to be no less effectual in cutting short an outbreak of plague in the plains than it has been found to be in the hills.

7. *Fevers* were, as usual, credited with having been the cause of more deaths than all other diseases together. Nearly 70 per cent. of the total number of deaths for the year were registered under this head. The inclusion of many deaths due to plague under the head of "fever" is believed to have had a share in swelling the return of deaths attributed to the latter. Much that is obscure regarding the nature of the fevers and the causes which determine the severity of their incidence in the different parts of the province still awaits investigation. It is essential, however, when competent officers can be deputed to carry out scientific work of this description, that they should be allowed sufficient time for its completion. Regarding the employment of the officers placed at his disposal, the Sanitary Commissioner writes: "Those I have had for short periods could do no valuable work for "the reason that before they realised the nature of the work they were transferred, while those who "were employed for longer periods in northern Bengal and western Bengal circles, have since 1897 "been employed entirely on plague work to the detriment of ordinary sanitation." It would be unreasonable to expect that scientific inquiries could be conducted to a satisfactory conclusion under such conditions.

8. A Report from the Sanitary Board follows that of the Sanitary Commissioner. Only one meeting of the Board was held during the year. A number of estimates for sanitary works were prepared and others were considered by the Board; but if the extent of the sanitary works actually carried out during the year, may be judged of by the amount expended in their execution, it would not appear that they can have been on a scale of great magnitude. "The total cost of sanitary "works carried out or in progress in towns and rural areas, by Municipalities, District Boards, "Government, and private individuals during 1900-1901" did not greatly exceed five lakhs of rupees in the case of towns, and six lakhs in the case of rural areas. Relatively to the sanitary needs of a province with a population numbering upwards of seventy-four millions these sums seem inconsiderable.

13th May, 1903.

No. 3.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of the United Provinces of Agra and Oudh for the year 1901.

In the history of the public health for the year there was little of an unusual character, or such as to call for lengthened comment. The annual report, written by Major Chaytor-White, who laboured under the disadvantage of having held charge of the duties of Sanitary Commissioner during no part of the year dealt with, is clear and concise. The year was a healthy one. Its chief meteorological features are described in considerable detail. Of these the most remarkable were the excessive heat of June and the defect in the rainfall of that month.

2. Throughout the report the census population numbers of 1901 are used in the calculations of ratios. The census just taken affords another illustration of the insecurity of the basis on which

estimates of population during intercensal years rest. If the population of these provinces for the year 1901 is estimated by adding to the figures of the previous census the excess of births over deaths during the intervening years, the total will be found to be in excess of the actual number by more than a million and a half. When a similar estimate was made at the end of the ten years following the taking of the census of 1881, the difference between the estimated and the actual numbers was only 206,436; and the smallness of this difference was accepted as an indication of the comparative accuracy with which the registration of births and deaths had been effected during those ten years. The divergence has thus increased more than sevenfold during the ten years just ended; but in view of the continued and even increased attention given to registration, it is difficult to believe that this can be due to a falling-off in the accuracy with which births and deaths were recorded. The explanation of this wide divergence between the estimated and the census population numbers of 1901 the Sanitary Commissioner confesses to be far from simple. He thinks "it is probable that deaths occurring among people on famine works were not fully reported; especially when cholera broke out in epidemic form." But it seems scarcely credible that a million and a half of deaths would escape registration even under such conditions of famine and epidemic disease. Calculated in the ordinary way for the years intervening between 1891 and 1901, by assuming that it would increase during those ten years at the same rate as that at which it had increased during the preceding ten years, the estimated would have diverged even more widely from the actual population numbers; for, whilst the census of 1891 showed an increase of more than two millions and three quarters over the preceding census numbers, the census of 1901 showed an increase of little more than three-quarters of a million over the figures for 1891. In exact figures, the population of 1901, estimated by adding excess of births over deaths to the preceding census numbers, differed from the population ascertained by enumeration by 1,595,229; and as estimated by assuming the rate of increase to have been the same as during the preceding ten years, it differed from the actual numbers by 1,967,293. Consequently, as the actual difference between the census numbers of 1901 and those of 1891 was only 786,991, it is obvious that the employment of estimated population numbers for the years intervening between the taking of the census of 1891, and that of 1901 would have increased, and not diminished, the error arising from using the previous census figures in calculating ratios. The disturbing effects of famines and epidemics cannot always be excluded from the reckoning when the population of an Indian province is being estimated.

3. The *birth* and *death* rates recorded for the year bear testimony to its healthiness. The former was above, and the latter below the quinquennial mean. The mortality ratios from all the chief diseases were less than the mean ratios for the decennium 1891–1900. The number of deaths from small-pox was the lowest on record, and yielded a death-rate of only 0·02 per thousand of population. Commenting on these figures, the Sanitary Commissioner says;—"The beneficent effects of vaccination were assuredly never more eloquently proved, and in this respect, we can, I venture to think, compare favourably with many European communities." The reduction of the mortality from small-pox to less than a thousand deaths per annum, in a population exceeding forty-seven millions, would seem to justify such a testimony to the efficiency of the vaccination department of the Province; but it needs no prophet to predict that the series of years of small-pox quiescence following the great epidemic of 1897 will inevitably lead up to another, although probably less violent, epidemic. An examination of the diagram in the vaccination report shows that, in a large number of districts, the ratio of successful primary vaccinations did not reach to more than half the birth rate. This was especially the case in the province of Oudh. It follows, that a large residuum of unprotected persons must be accumulating year by year in these districts. This accumulation will continue until the recurrence of a season favourable to the spread of small-pox, which is never altogether absent from the province, when another epidemic will break out, carrying off a certain proportion of the unprotected and rendering immune from further attack those who recover. Regarded in this light, the remarkable freedom from small-pox which the province has enjoyed since the fatal epidemic of 1897 carried off no fewer than 87,127 persons, is seen to favor the accumulation of the unprotected and susceptible element in the population.

4. Under the head of *fever* were recorded, as usual, by far the greater number of deaths during the year. To this cause was attributed a ratio of 23·46 of a total of 30·30 deaths from all causes. A very useful return of deaths according to their causes, verified by medical officers, medical subordinates and private medical practitioners, is annually included in the sanitary report of these provinces. As in previous years, a comparison between this and the general provincial returns shows that, in the latter, the mortality attributed to fever is enormously exaggerated, whilst that due to bowel complaints is greatly understated. Out of the total number of 11,578 deaths verified by professional agencies, it is worthy of remark that 17 were diagnosed to have been due to enteric fever. Of the 5,303 deaths amongst children under 16 years of age not one is stated to have resulted from enteric fever. In the course of his remarks on malarial fevers and the measures found to be most effectual in diminishing their prevalence, the Sanitary Commissioner says:—"I am inclined to think that money will be better spent in improving surface drainage and filling in tanks and depressions than in organising the so-called mosquito brigades, a measure that can only have a temporary benefit on a community. Considering the amazing fertility of the female *anopheles*, a continuous war would have to be waged to produce even an appreciable effect." In the prevention and cure of malarial fevers, drainage and quinine have gained rather than lost in importance as the result of recent research and discovery.

5. Deaths from *plague* are not separately recorded in the returns; but the disease seems at length to have secured a firm foothold in the province, and, in the words of the report, continues to recur annually in an ever-widening sphere. "Bad drainage, encroachment on streets, shutting out sunlight, overcrowding of inhabited sites in cities, and the prevention of through ventilation—all tend to render eradication of the disease more difficult and the spread of it more certain."

25th May 1903.

No. 4.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of the Punjab for 1901.

The area of the province has undergone material reduction since the last Report was written. Five of the districts hitherto constituting part of the Punjab are now included in the new North-Western Frontier Province; whilst the name of one new district appears in the list of the 27 still belonging to it. Notwithstanding the detachment of so many districts, the population, owing to its "natural increase," falls not far short of the number recorded when the census of 1891 was taken: it was then 20,724,940 and is now 20,274,136. "In the present report the comparisons which are made between the figures for 1900 and those for 1901 are comparisons of births and deaths registered in the area, and calculated on the population of the Punjab as at present constituted." It might have been useful if some explanation had been attempted of the causes which led to the increase in the population numbers in some districts and their decrease in others during the interval between the taking of the census of 1891 and that of 1901. Whilst in several districts the population numbers show a decrease, which is, however, in no case very considerable, in the majority of them the numbers show an increase. In one district the population has more than doubled between 1891 and 1901.

2. Judged by its vital statistics, the year under report was not a healthy one, although far less unhealthy than its predecessor. The *birth-rate* was 3·4 and the *death-rate* 11·6 lower than these rates for 1900. In the calculation of the ratios of births and deaths for the year, the new census figures of 1901 are used for the year under report, whereas the census figures of 1891 were, of course, used in calculating those ratios for 1900. But the population of the province had largely increased in the interval between the taking of the census of 1891 and that of 1901; so that the use of the census figures of the latter year has the effect of lowering the recorded birth and death ratios for the year under report. Had the same population numbers been used in calculating the ratios for both years, the birth-rate for 1901 would have compared more favourably and the death-rate less favourably with the birth and death-rates for 1900. The Sanitary Commissioner writes: "It will be seen that in 1901, according to the registered mortality, next to Bombay, the Punjab was the unhealthiest, and Madras, with a remarkably low death-rate of 21·3, the healthiest province in India." But vital statistics are still too imperfect in some provinces to admit of safe deductions being drawn from them. As a matter of fact, the public health during the year was far from good in the Madras Presidency. A recorded death-rate of 36·1 per mille of population in the Punjab, and a recorded death-rate of 21·3 in Madras cannot be accepted as a reliable measure of the relative unhealthiness of these two provinces during the year; they should rather perhaps be taken as an approximate measure of the comparative efficiency with which the registration of vital statistics is carried out in each of them.

3. In the Government review of the Report, the year, as regards its climatic conditions, the price of food, and wages of labour, is described as not having been unfavourable to the public health. *Cholera*, which in 1900 prevailed in destructive epidemic form, was almost entirely absent in 1901. In the former year no fewer than 24,840 deaths were caused by it; and in the latter only 180. A contrast so striking between the mortality from cholera in two consecutive years naturally suggests inquiry into the conditions which in the one year favoured its prevalence, and in the other conduced to its almost complete disappearance. The previous year was one of severe famine; but the history of cholera in other years and provinces shows that the prevalence and severity of this disease may bear no proportion to the extent and severity of the accompanying famine. Medical men are nearly unanimous in declaring cholera to be a "water-borne" disease. Assuming this to be the case, it might have been useful had an endeavour been made to ascertain in what specific respect the water-supply during the cholera year of 1900 differed from the water-supply during the non-cholera year of 1901.

4. *Small-pox* was less prevalent than in the previous year, the death-rate falling to 0·31 per mille of population from 0·51. Since the invasion of the Punjab by plague, *vaccination* has been carried on under great disadvantages. The causes which have led to the continued decrease in the number of persons vaccinated since 1896–97 are summed up in the Government review of the Vaccination Report for 1901–02. "Briefly, they have been a decrease in the number of births, scarcity, malarial fever, mortality among cattle, which has made it difficult to get buffalo calves, return of persons to the Native States who had sought refuge in our famine camps, and the employment of the Deputy Sanitary Commissioners and of vaccinators on plague duty, to which, in the case of the year 1901–02, may be specially added unusual sickness, which rendered a number of children unfit for vaccination, and the continued existence and disastrous spread of plague in the province, and in the principal native states, which caused a suspicion of vaccination operations in certain badly infected tracts, where, the people being in a disturbed frame of mind, it was thought the presence of vaccinators might lead to trouble." A favourable feature of the season's work is, as usual in the Punjab, the high proportion of children under one year of age amongst the vaccinated. The successful operations amongst infants under one year constituted 82 per cent. of all the successful cases. The quality of the vaccine lymph in use was in some cases very unsatisfactory. The need for improving the quality of the vaccine lymph supply is a matter of vital importance. Until the arrangements have been completed for the preparation of preserved lymph of reliable quality it might be advisable to employ, as far as practicable, only lymph direct from the calf. It is above everything essential for the successful working of the vaccination department, composed as it chiefly is, of a large number of subordinates on small salaries, and scattered over the province, that it should be efficiently supervised. The withdrawal of the Deputy Sanitary Commissioner for plague duty cannot but have had a very prejudicial effect on the work of vaccination in the Punjab during recent years. With the appointment, at length, of a whole-time officer to the charge of the Department, it may be expected that the work of the coming year may show improvement both in quantity and quality.

5. Of deaths from *plague* 14,959 were registered. But probably no great reliance can be placed on these figures. The Government point out that, at least, 17,000 deaths were due to plague. During the previous year only 495 deaths were reported as having been caused by it. These figures bear witness to the startling progress which the disease has made during 1901. The Sanitary Commissioner writes :—" In consequence of the abandonment of cordon arrangements in October 1900, but chiefly on account of the relaxation of all compulsory measures some months later, there was an enormous increase in the mortality from plague in 1901." The vast majority of cases were of the bubonic type of plague, though cases of pneumonic and septicæmic type were observed. In so far as information was obtainable, the infection of villages appeared to be due in nearly all cases to human intercourse. " In no instance could proof be obtained that infection was introduced by rats, though in many villages large numbers of dead rats were observed before the disease had spread." In connection with the question of anti-plague inoculation, the Sanitary Commissioner's caution should not be overlooked. When noting that a mild and less fatal form of the disease was reported from certain places in which a large number of the population had been inoculated, Colonel Bamber goes on to say :—" But before drawing conclusions favourable to inoculation, we require to know what the death-rate is in villages which have been affected by the disease for several years where inoculation has not been carried out. We know that other epidemic diseases, when first introduced into a community which has never suffered from such diseases, are much more deadly than they are among communities which constantly suffer from them."

6. To *fevers* was attributed by far the greater proportion of the mortality of the year. Although the death-rate from this cause fell from 32·3 in the previous year to 25·3 per mille of population, it was still much above the average. It is suggested in the Government review of the report that some of the deaths really due to plague may have been registered under the head of fever. This seems also to have been the case in the Province of Bengal; but in the Bombay Presidency it has been observed that, accompanying the rise and fall of plague prevalence, there is a corresponding movement in the mortality rate credited to " other causes " ; whilst fever, being a prominent symptom of plague, there is a tendency to avoid reporting deaths from it lest such report might suggest the existence of plague, and so lead to troublesome inquiries with the object of discovering the existence of plague cases.

7. *Sanitary Works.*—The report of the Sanitary Engineer, who has recently been appointed by the Punjab Government, follows that of the Sanitary Commissioner. The list of important sanitary projects submitted to the Sanitary Engineer is a long one. A water-supply and two drainage schemes were in hand during the year, whilst two more drainage schemes had been sanctioned. The important question of sewage disposal is receiving the attention of the Sanitary Engineer. He writes :—" During the year I took special note of the action taken by Municipal Committees to utilise sewage for irrigation purposes. Several towns are now taking this important matter up keenly, and as the cultivators are beginning to see more clearly what the advantages of farming with sewage are, there is more competition to pay a respectable price for it." Provided the necessory funds are available, there is scarcely any limit to the number of useful sanitary improvements which may now be carried out under expert supervision. " The only discouraging factor that I see ahead," writes the Sanitary Engineer, " is the one of ways and means."

13th May 1903.

No. 5.

Memorandum by the Army Sanitary Commission on the Report on the Sanitary Administration of the North-West Frontier Province, for the year 1901.

This is the first Sanitary Report on the recently created North-West Frontier Province. The five districts, of which the new province consists, previously formed part of the Province of the Punjab. Two of these five not having been transferred in their integrity to the new province, their vital statistics cannot be used for comparison with those recorded for them in the previous years. The total population of the new province, according to the census of 1903, is only a little over two millions, a number in some cases exceeded by the population of a single district in certain of the older provinces of India.

2. The year was a healthy one; the harvests were generally good, and there was no scarcity of food in the province. The recorded death-rate was only 19·2; but beyond indicating in a general way that the mortality was lower than usual, such figures are not worthy of much confidence. Quoting from the Proceedings of the Agent to the Governor General and Chief Commissioner of the Province : —" The registration of the births and deaths does not seem satisfactory." As the result of the inquiries made during the year by the Divisional Inspectors of Vaccination, it is estimated that one birth in six, and one death in ten, escape registration. It is safe to conclude that a considerable proportion of the births of female children remains unregistered, when it is seen that, according to the returns, the ratio of male to female children born is stated to be 123·2 of the former to 100 of the latter, and in one district 138·7 to 100. " This is said to arise from the unwillingness of Pathans to

register the births of female children." The recorded birth-rate of 29·5 for the province is not, however, an exceptionally low one, and exceeds that of several other Indian provinces, such as those of Madras, Bombay, and the Central Provinces, for 1901.

3. Of the chief diseases, *fever* had attributed to it by far the greater part of the mortality of the year. Under the head of *cholera*, 117 deaths were registered, as compared with 3,275 in the previous year, the Peshawar district and city contributing most of the cases. *Small-pox*, although considerably less fatal than in the previous year, accounted for 955 deaths. There was a falling-off in the number of vaccination operations during the year 1901-02 as compared with the numbers recorded in each of the two previous vaccination seasons; but this decrease is more apparent than real, and is largely due to the reduction in the size and population of the Bannu and Dera Ismail Khan districts, consequent upon the abstraction of portions of each of them to form the new district of Mainwali, now included in the Province of the Punjab. It appears, however, from the table given in paragraph 5 of the Vaccination Report, that the number of operations performed by each vaccinator was smaller in 1901–2 than in either of the two preceding years. Animal lymph was chiefly employed, and yielded the high percentage of 99·12 successful cases as compared with 96·75 when human lymph was used, and with only 88·08 when lymph prepared with vasaline was used. Inoculation is practised in the province, and so long as this continues to be the case, small-pox will probably be rarely, if ever, entirely absent from some part of it. If the success of the civil surgeon of Mardan in overcoming the prejudices of the people against vaccination, and inducing them to accept it in preference to inoculation, should be attained in other districts, there seems good reason to hope that the practice of the former may at no distant period entirely supersede that of the latter in the province. So far, *plague* has not extended to this part of India; "no case of plague was reported during the year."

4. No large sanitary works were undertaken during the year; but much was done, by cleaning and repairing wells, to improve the water supply, more especially in the Dera Ismail Khan district.

14th October, 1903.

No. 6.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Burma for 1901.

The weather conditions of the year were favourable to health. Although the rainfall was considerably in excess of the mean, the average humidity was less. The price of rice, the staple food of the province, varied but little from that which prevailed during the preceding year. The number of deaths was less than in 1900, although somewhat greater than the previous five years' average. But in comparing the mortality of the year under report with that of preceding years, the rapid increase of the population of the province has to be kept in view. According to the census of 1901, the population of the same area as that which yielded the census numbers of 1891 had, during the intercensal ten years, increased by 24 per cent. Assuming that the health of the year under report and that of one of the preceding years were equally good, the larger population of the former would naturally yield more deaths than the smaller population of the latter, provided the constitution of the population of both years, with regard to age, sex, &c., were similar. There is a wide divergence between the population numbers obtained by actual enumeration and the population numbers as estimated by adding to the census figures of 1891 the number by which the births exceeded the deaths during the intercensal ten years. According to the former the population has increased by 24 per cent., and according to the latter by only 14 per cent. But, although the defective registration of vital statistics is probably responsible in great part for this divergence, part of it is also doubtless due to the excess of immigrants over emigrants. No *data* are available by means of which a conclusion might be arrived at regarding the share which each of these factors may have had in producing this divergence between the estimated and the enumerated population of 1901.

2. Notwithstanding that the number of *births* registered during the year under report exceeded the number registered in the preceding year by 6,682, the substitution of the census figures of 1901 for those of 1891 in calculating ratios, has had the effect of reducing the birth-rate of the former year below that of the latter. The recorded birth-rate for 1901 was only 32·07 against 38·37 for 1900; but, had the census figures of 1891 been used in calculating ratios in both years, the birth-rate of the year under report would have worked out to be 39·9 instead of only 32·07 per thousand of population. Similarly, as regards the *death-rate* for 1901; if this be calculated on the census figures of 1891 it will be found to be 27·03, or only slightly below that of the preceding year; whereas, calculated on its own census figures, it is 21·74. Such calculations may not be without use as a caution against attaching too much importance to the recorded ratios of births and deaths of the year as measures of its healthiness in comparison with previous years. It is only in Lower Burma that anything like a complete system as yet exists for the registration of vital statistics. In Upper Burma, births are registered only in 13 towns, whilst regarding the registration of deaths, the Sanitary Commissioner writes:—"Owing to population figures for the rural tracts in which deaths are registered not being available for Upper Burmah the statistics for towns can alone can be shown in this year's report." Much may be done in Burma, as in the Indian Provinces, to improve registration by the systematic

testing of the registers of births and deaths by house-to-house inquiries and by suitably punishing those whose duty it is to record births and deaths, but who persist in neglecting it. Quoting from the report:—"There has been some improvement in the inspection and check of birth and death registers during the year, but more energy in this direction is still desirable."

3. Beyond stating that the mortality from them was less than in the previous year, the report has little to say regarding the chief diseases. *Plague* has, so far, failed to establish itself in Burma, although during the year "five suspicious cases were reported by the Plague authorities." All of these occurred amongst passengers arriving in Rangoon by sea, and three of them proved fatal. They were followed by no cases amongst the indigenous population.

4. Vaccination, to judge from the returns for the past two years, has not only been making no progress, but has been rapidly losing ground. As compared with the large number of persons vaccinated in 1899–1900, the number in the following year decreased by over eighty thousand; and now again the numbers vaccinated during the year under report falls short of the previous year's numbers by over fifty thousand. And accompanying this decrease in the quantity of work there has been a corresponding falling-off in its quality. Whilst in 1899–1900 a percentage of 94·71 was recorded to be successful in cases of primary vaccination, this percentage has fallen in the year under report to 90·27. The large decrease in the numbers reported as successfully vaccinated is due in great part, or altogether, to the detection and suppression of false returns hitherto submitted by the vaccinators. In the Vaccination Report for 1899–1900, the Sanitary Commissioner wrote:—"It is very evident from district reports that there is a considerable amount of false work returned by vaccinators; and district medical officers' inspections show that there is an appreciable amount of utterly incompetent vaccination, as well as a large proportion of second-rate work." In last year's *Memorandum* we made the following comment on the decrease in the number of persons returned as having been vaccinated:—"Great as the decrease is, it is not to be deplored, if the Sanitary Commissioner is correct in assigning it to stricter supervision and to the check which the submission of falsified returns has received." In a country like Burma, in which the introduction of vaccination has to contend against the ancient and popular-practice of inoculation, in the protective effects of which against small-pox the people have implicit faith, it is of the first importance that only vaccine lymph of good quality should be used, and only properly trained vaccinators employed. One civil surgeon reports that in several villages in which vaccination had, in previous years' been readily accepted, the people were reverting to inoculation. Altogether, it seems clear that the position of vaccination in Burma is at present unsatisfactory, and that drastic reforms will be necessary before it can regain the confidence of the people. Amongst these reforms will probably have to be included the free elimination of incompetent and dishonest vaccinators, the appointment of a sufficient number of trustworthy inspectors, and arrangement for securing an adequate supply of genuine vaccine lymph. Civil surgeons could, and no doubt will, give invaluable assistance in restoring vaccination in their districts to a sound footing.

5. Of the *sanitary works* in progress during the year the most important were those for providing the two largest cities of the province, Rangoon and Mandalay, with pure water supplies. The water at present available in Rangoon has been repeatedly pronounced to be unfit for drinking purposes. The progress of the scheme for providing Mandalay with pure water is said to be slow, and yet the need for its completion has for years been acknowledged to be urgent. But the backward condition of Mandalay is not confined to its objectionable water supply. "The condition of affairs as regards the conservancy of the town," the Sanitary Commissioner declares to be "more than discreditable to municipal management." For the two towns next in size, Moulmein and Akyab, water-supply schemes have been prepared, and in the case of the former, "work will very shortly be commenced."

No. 7.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of the Central Provinces for 1901.

The population numbers of the census taken on the 1st of March, 1901, are used in calculating ratios throughout the report. During the 10 years following the taking of the census of 1891, the population of these provinces is shown to have decreased by 881,483, or from 9,554,513 to 8,673,030. By increasing the mortality and diminishing the number of births, the severe famines of 1897 and 1900, with their accompanying epidemics of disease, were chiefly concerned in bringing about this decrease. During these two famine years the number of deaths registered exceeded the number of births registered by 639,962. Had all the deaths which took place in those two years been recorded, their excess over the births would probably have been greater. For, if the population of 1901 be estimated by deducting the excess of deaths (401,983) over the births during the intercensal period 1891–1900, the result would be a total of 9,152,530; whereas actual enumeration shows it to be only 8,673,030. The difference between these numbers, viz., 479,500 would represent the number of unregistered deaths during the decennium, unless it could be accounted for by emigration. In the United Provinces of Agra and Oudh the enumerated population of 1901 is shown to have been less than the estimated population by a million and a half. The Sanitary Commissioner of those provinces confesses his difficulty in finding an adequate explanation of this wide divergence; but thinks it "probable that

deaths occurring among people on famine works were not fully reported, especially when cholera broke out in epidemic form." As similar conditions of famine and sickness existed both in the Central and in the United Provinces, and as in each of these Provinces the census population numbers of 1901 fell far short of the numbers deduced by substracting, in the one case, the excess of deaths over births from the census figures of 1891; and by adding, in the other, the excess of births over deaths; the divergence in both cases is probably due to the same cause or causes. The comment made by the Sanitary Commissioner of the Central Provinces regarding the wide difference between the estimated and the census numbers of the population is, that this difference of nearly half a million is not "such as to indicate anything seriously wrong in the reporting agency." One would have subscribed to this conclusion with less hesitation had it been found possible to furnish some sufficient explanation of the difference other than incomplete registration.

2. The vital statistics of the year under review are compared by the Sanitary Commissioner, not with those of the year immediately preceding, but with those of 1898. The reason given for the selection of 1898 is, that this, like the year under review, followed a famine year. The *birth-rate* for 1901 was only 28·83, and, with the exception of 1897, was the lowest recorded in these provinces for 20 years. The Sanitary Commissioner thinks the result is not surprising in view of the generally low vital condition of the population following in the wake of two successive famines. At the same time, the ratio of *deaths*, which had reached 56·75 per thousand of population, in the previous year, fell to 23·46 in the year under report.

3. The mortality from all the *chief diseases*, excepting small-pox, was much below that of the preceding year. Of deaths from *cholera*, only 49 were registered as compared with 63,114 in 1900. *Small-pox* alone continued to prevail in severe epidemic form, and was accountable for upwards of 6,000 deaths. Judged by the number of operations performed during the preceding two years, the progress of vaccination can scarcely be regarded as satisfactory. From a total of 509,323 in 1899–1900, the number of persons vaccinated fell in the following year to 455,397; and now, in the year under report, to 425,392. The decrease is attributed chiefly to the low birth-rate of the year and to the unfitness of many of the children to undergo vaccination in consequence of ill-health. The percentage of successful cases was nearly the same as during the previous year. Animal lymph, presumably applied direct from calf to arm, gave the highest percentage of successful cases, and this was closely followed by human lymph used from arm to arm; the percentage of success in the case of the former having been 95·63, and in the case of the latter 94·66. Glycerinated lymph is credited with a percentage of success of only 90·06, and lanoline lymph of only 88·81. The number of calves inoculated for the purpose of supplying vaccine lymph seems enormous when compared with the number of persons vaccinated with calf lymph. Of the 9,922 calves inoculated, the operation was successful in the case of 9,037, unsuccessful in 679; whilst in the case of 206, suppuration or excessive inflammation necessitated their rejection. But calves for the supply of lymph would appear to be obtained without difficulty in the Central Provinces, seeing that, notwithstanding the large number of calves vaccinated, the total cost incurred during the year in the cultivation of lymph was only Rs. 184-1-6.

4. During the year under report, whilst *plague* continued to prevail in the neighbouring provinces, the Central Provinces enjoyed complete immunity; not a single indigenous case of the disease having been reported in them during 1901.

5. The deaths attributed to *fever* decreased to about half the number recorded in the preceding year. The question of adopting measures for preventing, or diminishing, the prevalence of malarial fevers by waging war against mosquitos received much attention. Meantime, the Government continues to encourage the use of quinine by the people by reducing its price and increasing the number of agents for its distribution throughout the province.

6. "The expenditure on *Sanitary Works*, whether under the direction of the Sanitary Board or otherwise, was very small." Needless to add that this was owing to the exhaustion of public and private funds consequent upon a succession of adverse seasons.

25th May, 1903.

No. 8.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Assam for 1901.

The Report, which fills the prescribed number of 12 pages, is clear and well-arranged. The small marginal tables introduced where necessary to explain the text are useful in saving constant reference to the figured statements in the Appendix. A paragraph briefly describing the chief climatic characteristics of the year and noting the prevailing food prices and rate of wages might have been of assistance in throwing light on the causes of the improved health of 1901 as compared with that of its predecessor, and with that of the preceding eight years.

2. There was a marked increase in the *birth-rate* and a still more marked decrease in the *death-rate* as compared with the corresponding rates for the previous year; but very little is said in explanation

of the causes of such increase and decrease. The birth-rate of the year under report rose to 33·98 from 32·31, the latter being the average for the preceding eight years, whilst the death-rate fell from an average of 34·93 in those eight years to 27·85. But there can be no doubt that, as a consequence of the defective state of the registration of vital statistics in the province, the birth and death-rates are understated.

3. The Sanitary Commissioner devotes a considerable portion of his report to the important subject of registration of vital statistics. The question has been repeatedly discussed, and remains much in the same position as hitherto. In the districts in which registration is effected by paid village watchmen, the record of births, and, in so far at least as their mere numbers are concerned, of deaths also, is carried out with some approach to accuracy. These village watchmen are under effectual supervision and control, being liable to be fined or otherwise suitably punished for neglect of their duties. But, unfortunately, these paid agents are employed only in the two districts of the Surma Valley and in one of the six districts of the Brahmaputra Valley. In the remaining five districts of the latter, unpaid and irresponsible agents, locally known as *gaonburas*, or head-men of villages, are entrusted with the collection of vital statistics and perform this duty badly. The results obtained clearly illustrate the comparative value of each of the two kinds of agents. Whilst the three districts in which paid village watchmen are employed return birth-ratios varying from a maximum of 44·25 to a minimum of 35·38 per thousand of population, the five districts in which unpaid *gaonburas* are expected to carry out the work of registration, return rates varying from a maximum of 31·36 to a minimum of only 26·28 per thousand of population. "Indeed the figures for Kamrup, Nowgong, Sibsagar, and Lakhimpur may be looked upon as practically worthless, and those for Darang are very little better." It would obviously be useless to submit such figures to a minute analysis, and unsafe to draw from them conclusions regarding the health conditions prevailing in the districts for which they are recorded. The Government are fully aware of the unreliable nature of the vital statistics recorded in the districts in which unpaid agents are employed for their collection, and anxious to effect their improvement. After remarking that their vital statistics would lead to the conclusion that the two healthiest districts in the province had the lowest birth-rates, the Government add :— "These figures indicate that the vital statistics of Assam are most inaccurate, especially in the Brahmaputra Valley, where there is no paid agency for collecting them. The Officiating Chief Commissioner would be reluctant to add to the subordinate official staff of the province simply for statistical purposes, but it may be possible to improve matters by attaching some remuneration to the office of village head-men (which now carries no emolument), and this question will be considered." Without an approximately accurate record of its vital statistics, neither can the sanitary wants of the province be estimated, nor the effect on health of the introduction of sanitary improvements gauged with any approach to certainty. At present, these statistics are so inaccurate as to be not only worthless but liable to mislead.

4. Of the chief diseases *cholera* showed a remarkable abatement in severity. The number of deaths due to it was less than a third of that recorded under the same head in the previous year; and less than half of the average number during the previous fifteen years. To what cause or causes this lessened prevalence of cholera was due no attempt is made to explain. Cholera prevalence being considered by many to be influenced directly or indirectly by the rainfall, it might be useful in future reports to give some account of the character of the rainfall of the year, noting whether it was excessive, normal, or defective in quantity, and whether it was seasonable and regularly distributed or otherwise. The cholera death-rate on tea-gardens again exceeds the general provincial rate, the former having been 2·17 and the latter only 1·42; but taking into account the very incomplete state of birth and death registration amongst the general population, and what may be assumed to be the comparatively accurate record kept of deaths on tea-gardens, too much importance need not be attached to a comparison of these ratios. The number of tea-garden coolies imported during 1901 was less than in any one of the preceding 13 years; and the cholera death-rate amongst them "whilst in transit from Goalundo to the post nearest to the place of their employment," has been lower in three only of those 13 years. Possibly some connection might be traced between the number of coolies annually imported and the percentage of those attacked by cholera during transit. Referring to the marginal table to paragraph 28 of the Report, it will be seen that the four years returning the largest numbers of coolies imported were all of them years of abnormally high ratios of cholera mortality; and that the four years returning the smallest numbers of coolies imported were all of them years of low ratios of cholera mortality amongst the coolies during transit. These figures may not be without their significance.

5. *Small-pox* was considerably more fatal than in either of the preceding two years, but except in one district, the death-rate due to it was less than one per thousand of population. The cause of the greater prevalence of the disease in the district in which the mortality exceeded one per thousand is believed by the District Medical Officer to have been the diffusion of small-pox infection by the practice of inoculation. The Sanitary Commissioner agrees with the District Medical Officer mentioned in proposing to extend the Act for preventing inoculation to the whole of the district of Sylhet. The prevention of inoculation would be justifiable only if vaccination were first placed within the reach of every one of the inhabitants of the district. The prejudice in favour of inoculation might perhaps be tolerated were only those who prefer and practise it the sufferers, but unfortunately its chief victims are their neighbours, and generally their poorer neighbours, who are unable to pay the somewhat heavy expenses connected with the operation. The numbers vaccinated in the province show a considerable increase over those for the preceding year, and a large increase over the average for the 15 years 1884–85 to 1898–99. The reported percentage of successful cases of primary vaccination was as high as 97·48, and in re-vaccination 81·09. "The quality of the lymph was generally excellent throughout the year," but further experience would appear to show that Colonel Campbell was somewhat too sanguine in his estimate of the length of time during which glycerinated lymph would retain its activity unimpaired. In his Annual Report of the Animal Vaccine Depôt at Shillong for the year 1899–1900, he writes :—"Two thousand tubes

manufactured on 11th February and 15th February, 1900, were forwarded to the Principal Medical Officer and Sanitary Commissioner, Assam, to be kept for experiment to see if lymph will keep in the plains through the hot weather if not exposed to sunlight or heat, *i.e.*, if simply shut up in a wooden box. I believe this will prove to be the case." In his Report on Vaccination for 1901–02 the Sanitary Commissioner, after detailing the experiments conducted with glycerinated lymph, writes :—"I think it may therefore be concluded that the glycerinated lymph as stored in hermetically sealed tubes will not keep for more than four months, even in a cool place, and it begins to deteriorate after three months' storage. It has further been ascertained that it will not keep for two months in the plains in the hot weather, and probably not for more than one." It is satisfactory to learn that the mortality among the calves used for the supply of lymph has been reduced to less than half that reported in the previous year. Only 12 calves died in the year under report, as compared with 26 in the previous year, and with 41 in 1899–1900.

6. The mortality from *fever* was somewhat greater than in the previous year, but not above the average for the 15 years 1884–1898. As the Sanitary Commissioner had predicted, the form of fever known as *kálá-ázár* continues steadily to decrease in Assam. It now only exists to any serious extent in two districts of the Brahmaputra Valley, and even in these it is steadily abating. Unfortunately it is beginning to show signs of activity in the Surma Valley. Quoting from the Government review of the report—"But whilst loosening its grasp of the districts in the Brahmaputra Valley it has effected a lodgment in Sylhet, where the density of the population is 412 persons to the square mile as compared with 108 for the Brahmaputra Valley."

7. Of *Sanitary Works* it is stated that no one of magnitude was undertaken during the year, and no provincial scheme of any importance was under consideration. What of funds were available for sanitary improvements in rural areas were principally expended in providing better water-supplies; but in the concluding words of the Government resolution on the Report, "It must, however, be realised that the funds available for village sanitation are very small."

13th May, 1903.

No. 9.

Memorandum by the Army Sanitary Commission on the Rajputana Sanitary, Vaccination, Dispensary and Jail Report for 1900.

The report on the working of the several departments above enumerated has been reduced to a few pages of summary comment on each. The history of sanitation in Rajputana, with its population of twelve and a half millions, during a year of excessive sickness and mortality is compressed within less than half a dozen pages, not counting the figured statements. The year was one of abundant rainfall. In Ajmere the amount of rain registered exceeded 25 inches, as compared with only 10 in the preceding year; and in Bewar 23·47 as compared with only 5. "The harvests, generally, were good, but the people, enfeebled as they were by past privations, fell an easy prey to the epidemics of cholera, malarial fever, dysentery and small-pox that ravaged the province during the autumn of 1900."

2. As in previous years, the only part of Rajputana which furnishes vital statistics having any claim to accuracy is Ajmer-Merwara. The population of this district, according to the census of 1891, numbered 542,368 out of a total for Rajputana of upwards of twelve and a half millions. The *birth-rate* in Ajmer-Merwara for the year under report fell to 14·67 per mille of population from 31·40 in the previous year; whilst the death-rate rose to no less than 119·97 from 33·21. In other words, for every birth recorded during 1900 there were more than eight deaths. The census figures of 1891, now available, show that during the decennium 1891–1901 the population of Ajmer-Merwara decreased by 66,028 or 12·17 per cent., whilst during the preceding decennium it had increased by 17·72 per cent. The Residency Surgeon and Chief Medical Officer writes :—"The mortality of the famine year 1900 was 65,067. The excess beyond the average, viz., 49,967, may be taken as the minimum number whose deaths were due either directly or indirectly to famine and its attendant diseases." Striking as these figures are, there is no doubt that many deaths escaped registration during the famine period, "especially when people deserted the famine camps as soon as cholera appeared, and many of the wanderers died by the wayside in consequence." If, during a year of so great distress, registration of births and deaths is acknowledged to have been incomplete in a division of the country under direct management of Government, little reliance can be placed on returns of vital statistics furnished by the Native States. "Registration has been attempted in 18 Native States as in the previous year, but so far with unsatisfactory results. At the time of the Famine Commission in Ajmer in February last, an attempt was made to get statistics similar to those supplied to the Commission from the Ajmer-Merwara District, but the universal reply was, 'Information not available.'"

3. *Chief Diseases.—Cholera*, from which Ajmer-Merwara had been almost entirely free during the previous year, prevailed in severe epidemic form throughout the district. Whilst in 1899 only one death was attributed to it, the number of cases recorded during the year under report was 5,621 and the deaths 4,841. The number of deaths ascribed to cholera in the Native States was 28,719; but if the disease was not less fatal in these States than in the Ajmer-Merwara district, the number must be

understated. If cholera carried off 4,841 persons out of a population of half a million in Ajmer-Merwara, it is scarcely probable that it carried off only 28,719 out of a population of over twelve millions. If the recorded number were doubled it would probably still fall short of the actual number. The measures adopted with a view to arrest the progress of the epidemic are thus mentioned: "All necessary precautions were taken throughout the Ajmer-Merwara District in the way of sanitation and disinfection of wells to stop the disease, and cholera pills were distributed in all villages." A more detailed account of the epidemic and of the measures found to be most effectual in controlling it might have been useful in dealing with future outbreaks.

4. *Small-pox* prevailed in severe epidemic form in Ajmer-Merwara, causing 2,610 deaths, or a ratio of 4·8 per thousand of the population. In the Native States the number of small-pox deaths registered was only 3,051, or 0·25 per mille of population; but this number probably represents but a fraction of the actual mortality from this disease. In Annual Vaccination Statement I. the average ratio per thousand of the population of Ajmer-Merwara successfully vaccinated during the previous five years is recorded to have been 34·08; and in the Native States only 26·13; so that, if the mortality from small-pox bore any proportion to the protection afforded by vaccination, the people of the Ajmer-Merwara division should have suffered less instead of sixteen times more severely than those of the Native States. During a year of excessive sickness it was only to be expected that there would be a decrease in the number of persons vaccinated. The number of children was abnormally small, and many of them were so weakly as to be unfit to undergo vaccination. But, in spite of the disadvantages under which vaccination was carried on during the year, the same astonishing ratios of successful cases as in previous years are recorded. In Ajmer-Merwara the percentage of successful cases claimed was 99·20; and in no fewer than four of the Native States every primary case of vaccination was returned as having been "successful."

5. In Ajmer-Merwara, the only portion of Rajputana for which reliable vital statistics are available, *malarial fevers* are credited with a death-rate of no less than 81·56 per thousand of population as against a mean of only 19·52 for the previous five years. The mortality due to *dysentery* and *diarrhœa* rose to 15·90 per thousand of population from a mean during the previous five years of 1·12. The province fortunately escaped during such a calamitous year an epidemic of *plague*. Only two cases, both of them imported, were reported during the year.

6. No new *sanitary work* of importance appears to have been undertaken during the year. The Chief Medical Officer reports that "in several of the Native States the Medical Officers do not take an active part in the work of sanitation and the registration of vital statistics of the Head-quarters stations to which they are accredited, and these important matters are entirely in the hands of Native officials, with unsatisfactory results."

7. The section of the Report dealing with the working of *Dispensaries* during the year calls for no special remark.

8. Owing to the prevalence of famine, the *Jail* population of the province was greater than in the previous year. The sickness and mortality amongst the prisoners were enormous. In the Ajmer jail the average sick-rate rose from 6·24 in the previous year to 14·57; and the death-rate from 5·32 to 77·32. In the jails of the Native States, whilst the cases treated more than doubled, the number of deaths increased from 155 in the preceding year to no less than 1,420 in the year under report, or to a ratio of 215·04 per thousand prisoners. In one jail, with a daily average strength of 230·59 prisoners, the number of deaths was 416, or at the rate of 1,804·07 per thousand of strength. This terrible mortality was, no doubt, in main part due to the bad state of health of the prisoners at the time of their admission into jail; but the overcrowding, defective drainage and construction mentioned in the Report must also have contributed to swell the sick and death rates.

9. *Summary.*—Exigencies of space have reduced the Report to a brief commentary on the statistical returns. The health conditions of 1900 were exceptional. Whilst the birth-rate fell to less than half that recorded for the previous year, the death-rate rose to no less than 119·97 per thousand of the population. Under normal conditions the death-rate rises and falls with the rise and fall of the birth-rate; but in the year under report the abnormally high death-rate accompanied an abnormally low birth-rate. The causes of this disturbance of the ordinary relation between birth and death ratios were famine and destructive epidemics of disease. The account given of the epidemics of cholera, fever, and small-pox are meagre. As might have been expected, vaccination work decreased during such a year; but there is a repetition of the extraordinarily high percentages of successful vaccine operations hitherto recorded in Rajputana. Under the influence of famine, the numbers of the jail population greatly increased, and the amount of sickness and mortality amongst the prisoners, more especially in the Native States, was excessive. Although abnormal sickness and mortality were mainly due to the famine and the epidemics of disease from which the province suffered, the overcrowding and defective sanitary conditions existing in some of the jails doubtless had a share in their causation. In one jail the almost incredible ratio of 1,804·07 deaths per thousand of the average strength of the prison population is recorded. Such figures are of themselves sufficient indication of the need for strenuous endeavour to ameliorate the lot of the prisoners in some of the Native States.

24th January, 1903.

No. 10.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Madras for 1901.

The volume containing the Reports of the Sanitary Board, Sanitary Commissioner, and Sanitary Engineer for 1901 appears in a much attenuated form. Each of the three reports has now been reduced within the limits prescribed by the Government of India. During the year the Sanitary Board scrutinized the plans and estimates of 85 sanitary works of the total estimated value of nearly fourteen and a half lakhs of rupees. Among the new type designs issued is one for a cheap description of latrine for rural purposes, and another for a private house latrine. The former was evolved after prolonged consideration by the members of the Board, and claims to be based on sound sanitary principles. If the latrine is found in practice to be efficient and to satisfy the requirements of the rural population, an important step will have been made towards overcoming one of the chief difficulties hitherto met with in the effort to keep clean Indian villages and their environment. The publication of these type designs will enable the sanitary authorities in other Indian provinces to profit by the useful investigations and inventions of the Sanitary Board of Madras.

2. The year was one of increased mortality and decreased fecundity: in other words, it was unfavourable to the public health. The rainfall recorded for the Presidency, as a whole, was 3·5 inches above the average of the ten years ending 1898; but from such a statement no deduction can be drawn regarding the fall in particular districts. It is shown that notwithstanding the general rise in the average rainfall for the province, there was a deficiency in some districts amounting to as much as 28·7 per cent. of the decennial average. The staple food grains, *cholam*, *raggi*, and *cumbu*, cost on the average respectively 15·6, 15·7, and 15·1 seers per rupee, against a decennial average of 20·4, 22·5, and 20. Unless so great a rise in the price of food was accompanied by a corresponding rise in wages the people must have felt the pressure of hard times severely. To this pressure the unfavourable health statistics of the year were doubtless in great part due. The Sanitary Commissioner says:—"The rate of wages is slowly increasing." If procurable, some figures to show the movement in the scale of wages of the labouring classes might usefully accompany the record of prices of food grains.

3. The census numbers of 1901 are used throughout the report in calculating ratios. The "natural increase" of the population of the Presidency since the previous census was taken in 1891 was 2,572,646, or at the rate of 6·99 per mille, excluding Feudatory States. This shows a remarkable decrease when compared with the "natural increase" of 4,879,894 in the previous intercensal period. As the Sanitary Commissioner points out, if the census figures of 1891 are used in the calculation of birth and death rates for each of the succeeding intercensal years, there will be a constantly increasing error in the resulting ratios which will reach its maximum in the last year of the series. With the introduction of the new census figures in 1901 the error will be rectified, but only to recommence and keep increasing during succeeding years until next census is taken in 1911. It is true that the method of calculating birth and death ratios on the census figures during the entire intercensal period has the effect of showing an apparent increase in these ratios which might be erroneously credited to improved registration, provided that the population increased from year to year. The Sanitary Commissioner says, "This would at all times be avoided by use of 'estimated populations.'" The method of "estimating" the population of a country during each of the intercensal periods is based upon the assumption that the rate of increase, or in exceptional cases decrease, will be the same during the coming intercensal years as it had been during the immediately preceding intercensal period. But in the case of the Madras Presidency the increase of the population numbers between the taking of the census of 1881 and the taking of the next in 1891 amounted, as already stated, to 4,879,894. Consequently, if the population of each year succeeding the taking of the census of 1891 were "estimated" by adding a tenth of this number to the figures for the preceding year, it is obvious that the estimated population numbers would be largely in excess of the actual numbers; for the census of 1901 shows that the increase during the years since the previous census was taken was only 2,572,646, or but little more than half the increase during the preceding intercensal period. If, therefore, the ratios of births and deaths had been calculated upon the population numbers of each of the intercensal years succeeding 1891, "estimated" as described, they would still have erred, although in an opposite direction; they would, in fact, have been nearly as much in defect as those calculated on the census numbers of 1891 are in excess of the real ratios.

4. The *births* during the year under report show a decrease of 113,450, and the *deaths* an increase of 25,281 as compared with the numbers recorded in the preceding year; but yet the total births exceeded the total deaths of the year by 139,609. As in the previous year, the birth and death rates recorded in town circles are much in excess of those recorded in rural circles. Whilst the town circles record a birth-rate of 30·7, the rural circles record a birth-rate of only 24·6 per thousand of population, according to Table I. of the Appendix. This is a reversal of the relation which the birth-rate of towns ordinarily bears to that of the country. The Sanitary Commissioner offers an explanation which, he thinks, might account for the greater fecundity in towns. "That the town population of the Presidency should have been less influenced than the rural as to fecundity by the high price of food-grains, seems to support the view that the pressure was chiefly upon the lowest classes of the agricultural population." But if the pressure of the high price of food-grains was chiefly on the lowest classes of the agricultural population, it might be expected that the mortality amongst these would, as a consequence, be higher than amongst the inhabitants of towns, on whom the pressure was less, or at all events that it would not be abnormally low. On the contrary, however, whilst the death-rate recorded in town circles was 32·7, that recorded in rural circles was

only 20·4. As suggested in our *Memorandum* for 1900, an explanation of this abnormal contrast between the birth-rates of rural and town circles in Madras might perhaps be found in the more defective way in which registration was carried out in the former than in the latter. The fact that "in all municipal areas registration of births and deaths was compulsory" would support this suggestion. Moreover, a reference to the vital statistics of the neighbouring provinces of Bengal and Bombay, for the same year, shows that the birth-rate of the former province was only 22·74 per mille in urban, as compared with 39·39 in rural circles; and of the latter province 22·72 as compared with 25·27. The birth-rate, therefore, in the two neighbouring provinces follows the usual rule of being higher in the country than in towns; whilst in the Madras Presidency it is unusual in being lower in the country than in towns.

5. *Cholera* was exceptionally fatal during the year, accounting for 91,307 deaths. The Government, in requesting that in future reports the relation between the prevalence of cholera and the existence of a protected water-supply should be noticed in more detail, point out that whilst the cholera mortality in all towns taken together was 2·7 per mille, the ratios in those which had a protected water-supply was 1·97.

6. *Small-pox* mortality shows a slight decrease as compared with that recorded in 1900, but is still high. Of the 26,202 deaths recorded, no fewer than 8,029 occurred among children of less than one year of age; whilst 7,131 occurred among children between one and ten years. These results are only those to be expected when it is seen that, whilst there were 935,749 births recorded during the twelve months of the calendar year, there were but 354,527 successful vaccinations of children under one year of age in the twelve months of the official vaccination year. Satisfactory features of the year's vaccination work are the increase of 67,223 operations over the number for the previous year, and the increase in the number of operations performed by each vaccinator from 1,473 to 1,584. Important as the increase of the vaccination establishment would be to meet the growth of the population of the Presidency, perhaps a still more important need is the improvement of the quality of the vaccine lymph. From the table given in paragraph 10 of the Vaccination Report, it appears that, of 1,159,880 successful operations, 414,476 were performed by the staff paid from local funds; and that in these latter cases glycerinated lymph, locally prepared in different centres, was employed. The resulting percentage of successful cases following the use of this lymph was only 86·9, as compared with 98·4 obtained in the 216,606 cases vaccinated by the calf-to-arm method by the same staff of operators. Although the results obtained by municipal vaccinators using glycerinated lymph were better than those obtained by the local fund vaccinators, they were still far less favourable than those following the use of lymph applied directly from the calf to the arm. After remarking that the quality of work done is not so good as it was ten years ago, the Government add:—"The marked fall in the measure of success obtained with glycerinated lymph is a matter of serious importance, which has not received adequate notice from either the Inspector of Vaccination or the Sanitary Commissioner, but the Government trust that the opening of the Vaccine Institute will result in the supply of lymph of uniform and reliable quality."

7. This Presidency has hitherto maintained a successful combat against *plague* invasion from Bombay and Mysore; but the returns for 1901 would appear to show that the defence is at length being overpowered. The number of attacks arose from 895 in the preceding year to 3,960 in the year under report. The "passport system," which has hitherto successfully resisted the spread of plague, is still being persevered with, and the Sanitary Commissioner shows good reasons for claiming that numerous localities have been saved from plague by the prompt discovery of cases of the disease.

8. As usual, *fevers* were the most fatal of all the diseases. In the paragraph devoted to these, the remarks regarding typhoid fever are of interest in connection with the question of the prevalence of this disease amongst the natives of India. Colonel King writes:—"A diagnosis of typhoid fever is common enough on the Nilgiris and at times in Malabar and South Canara, but it is rare in the plains, although I have personally seen cases from time to time in the Trichinopoly and Kurnool districts." He adds:—"Lieutenant-Colonel Wilkins, District Medical and Sanitary Officer, Malabar, has sent me a list of 73 cases treated in the various hospitals in his charge during the last ten years." These remarks support the conclusions regarding the comparative liability of Europeans and Natives to typhoid fever arrived at from an examination of the records of sickness and mortality in the Native Army and Jails of India. Quoting from our *Memorandum* on the Report of the Sanitary Commissioner with the Government of India for 1900:—"Reliable statistics of the disease amongst the natives of India are mostly limited to those furnished by the Native Army and Jails. Whilst the recorded deaths from enteric fever numbered 289 out of a strength of 60,553 European soldiers, there were only 18 in the Native Army, with rather more than double the strength, and only 17 out of an average strength of 121,511 prisoners."

9. The water-works extension at Trichinopoly, and the Vizagapatam and Cocanada water-works, which had been commenced in 1900, appear to have been the only sanitary works of importance under construction during the year. The Sanitary Commissioner thinks that, unfortunately, it is not probable that much advance in large sanitary works, such as those for water-supply and sewage, will be recorded in future sanitary reports of this Presidency, having regard to a recent ruling of the Government of India, that grants-in-aid will not be given to local bodies. The important scheme for training a sufficient staff of Sanitary Inspectors for the requirements of Municipalities and Local Boards is being successfully carried out.

13th May 1903.

No. 11.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Bombay for 1901.

The Report is mostly a repetition in narrative form of the statistical tables attached to it as an appendix, and consequently affords but little matter for comment. In the Government review it is disposed of in a page ; whilst the accompanying Vaccination Report is considered to call for no special remark. Questions connected with the origin and spread of the diseases which were the chief causes of mortality, such as fever, plague and cholera, are scarcely touched ; and there is but little account given of the measures adopted with the object of checking the progress of such diseases. A brief record of the experiences and observations of the medical officers engaged in the investigation of the causes of sickness and mortality prevalent during the year, and in devising and carrying out measures for dealing with them, could not have failed to be useful.

2. The year under report was less unhealthy than its predecessor. In spite of the great increase of plague, the total mortality fell to nearly half that recorded in 1900. Of the chief meteorological features of 1901, no account is given beyond the remark that the rainfall was below the average in all of the districts except two, and that in others it was only about half the annual average. During the previous year the deaths exceeded the births by no fewer than 813,121 ; and this year again they are in excess by 220,487 ; so that, leaving out of count immigration or emigration, the population of the province has undergone a decrease of upwards of one million in the two years 1900 and 1901. The *birth-rate*, 25·19, was the lowest recorded for any one of the last ten years ; whilst the *death-rate*, 37·12, was somewhat higher than the decennial mean.

3. The number of deaths from *cholera*, which had suddenly increased from 8,579 in 1899 to 163,889 in the following year, as suddenly fell in the year under report to 13,600. According to the Government review, "famine conditions prevailed throughout the year 1901 in Gujarát and the Northern Deccan, owing to the partial failure of the monsoon both in 1900 and 1901." Turning to Annual Form No. VI. it is seen that, in spite of its having been afflicted by famine, Gujarát is one of the only two Registration Districts of the province that did not record a single death from cholera ; another illustration of what has been more than once observed during recent famine years in India, that there is no necessary connection between cholera and famine prevalence. Nor did "the partial failure of the monsoon," with the deterioration of the water-supply which may be assumed to have resulted, prove sufficient to light up an outbreak ; although the impurity of the drinking water consequent upon a deficient rainfall is not infrequently assigned as a cause for cholera. These conditions, famine and impure water, although known to be favourable to the development and spread of cholera, appear to be incapable even when, as in this instance, acting together, of originating an outbreak in the absence of the specific exciting cause of the disease.

4. The deaths from *small-pox*, which had been more numerous in 1900 than in any one of the previous ten years, fell during the year under report to nearly half. Of persons primarily vaccinated there was a decrease in number of 115,961 as compared with the number for the previous year, as well as a decrease of 23,372 re-vaccinations. The decrease is attributed to "a low birth-rate, consequent upon the incidence of famine and plague" ; and to opposition to vaccination in Sind. In this Presidency humanized vaccine lymph is still chiefly used ; and, except in the Sind Registration Circle, it yielded a higher percentage of successful cases than animal lymph. In the Presidency Circle alone no vaccinations were performed with human lymph ; and, here, animal lymph was followed by a much lower percentage of success than the humanized lymph used throughout the rest of the province. Glycerized lymph was only used in 583 cases and yielded the low percentage of 73·42 ; the lowest percentage of success following vaccination with humanized lymph having been 86·81 and the highest 93·37. Altogether, as the Sanitary Commissioner observes, "the present year has been a very disastrous one for vaccination." It is of the very first importance that arrangements should be made for the provision of an adequate supply of good vaccine lymph. In India, some of the provincial vaccination departments, in their zeal to introduce the changes adopted during recent years in the practice of vaccination in Europe, have omitted to take the preliminary measures necessary for securing the successful working of the altered methods. Until the arrangements are complete for providing calf lymph prepared by admixture with glycerine in such a way as to preserve its activity unimpaired, and to supply it in sufficient quantity, it would be expedient to continue the use of lymph taken direct from the calf. But here again, there is not infrequently a difficulty in procuring calves for the supply of the required quantity. In the last resort, however, human lymph is available ; and the result of a century's experience of the almost exclusive use of human lymph has been that, except in rare instances, and those mostly due to carelessness, no ill effects have been known to follow its employment. Hitherto, in India, glycerized lymph has not yielded so successful results as human lymph, if those reported from Assam be excepted.

5. Whilst the mortality attributed to *fever* decreased to nearly half that recorded in 1900, the number of deaths from *diarrhœa* and *dysentery* fell from 218,243 to 60,198. The enormous mortality from bowel complaints in 1900 may be taken as some measure of the severity of the famine in that year. Of the destructive epidemic of *plague* very little is said in the report beyond the remark that the mortality due to it was the highest hitherto recorded. The number of deaths reported from plague was 33,196 in the previous year, and in the year under report 128,259. The ratio of deaths registered under the heading "other causes," which began to increase from the time of the appearance of plague in the Presidency in 1896, still goes on increasing. In previous *memoranda*, reasons have

been given for believing that this increase is due rather to causes connected with plague prevalence than, as the Sanitary Commissioner suggests, to improvement in the registration of deaths according to their causes.

6. In the Report of the Sanitary Board it is stated that "owing to plague and famine, local bodies were unable during the year to take up any important sanitary projects." An experimental sewage farm has been established with the object of ascertaining if the sewage of Poona city can be profitably disposed of in the fertilization of the soil and the raising of crops, instead of being wastefully and perhaps injuriously discharged into the river. The result will be watched with much interest by the municipal authorities of other cities in which the question of the best means for the disposal of sewage still remains unsettled.

7. The Report of the Port Health Officer of Bombay is, this year again, a record of strenuous and successful endeavour to prevent the dissemination of infectious diseases by ships leaving the port. Compared with its predecessor the year was one of much lower mortality from cholera and small-pox; but plague was more prevalent. In Bombay City 18,736 deaths from plague were recorded during the year; yet amongst the crews and passengers, numbering over eight hundred thousand, on board the inspected ships leaving Bombay, only three persons who could have been infected before sailing were reported to have subsequently developed the disease.

13th May, 1903.

No. 12.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner for the Hyderabad Assigned Districts for 1901.

The year, which was an unusually healthy one, has its sanitary history sketched in a Report covering only four pages. The lowness of its birth and death rates was in some degree the consequence of the conditions of famine and sickness which had prevailed in the preceding year. Whilst the usual effects of antecedent famine on fecundity are indicated in the low birth-rate, the death-rate is also low, because of the accompanying low birth-rate; and also because, in the words of the Sanitary Commissioner, "most of the aged, weakly, and sickly had succumbed to the famine privation of the previous year." It might have been added that the very young, as well as the very old, succumbed in unusual numbers to the privations of the previous year. The infant mortality in that disastrous year reached the enormous ratio of 478·5 per thousand. As a result of this excessive mortality amongst infants in 1900, and of the small number of children born during 1901, the proportion of infants in the latter year, or in other words of those most "liable to death," was unusually low. This must have combined with the other causes mentioned to lower the death-rate from 82·7 in 1900 to only 27·6 in the year under report. Influenced as, of course, it chiefly was by the antecedent conditions prevailing in 1900, the birth-rate fell from 31·3 in 1900 to 30·8 per thousand of population.

2. An account is given of the measures taken to ensure the careful registration of vital statistics. The census figures of 1901 bear remarkable testimony to the efficiency of the registration of births and deaths in this province. When the births registered since the previous census of 1891 are deducted from the deaths registered during the same period, and the number (150,803) by which the deaths exceeded the births is subtracted from the population figures of 1891, it is found that the population numbers of 1891, thus estimated, differ from the numbers ascertained by the census by only 15,324. The number of registers of births and deaths inspected was somewhat smaller than in the previous year; but the inspection was evidently more thorough. The system of checking the entries in the registers by house-to-house inquiry is tedious and laborious; but in no other way can errors be detected with certainty.

3. *Cholera*, which carried off no fewer than 18,375 persons in 1900, was almost absent from the province; only 17 deaths having been attributed to it during the year under report. To the paragraph describing the slight outbreak which caused the deaths of 16 out of the total number of 17 deaths, the Sanitary Commissioner adds:—"Permanganate of potash was freely employed as usual for disinfection of all wells and polluted sources of water supply." This use of permanganate of potash during times of cholera prevalence has, in many parts of India, come to be more or less a matter of routine. And yet, there is little, if any, evidence of a reliable nature to show that the permanganate exercises a specific effect in destroying the cholera poison in the wells and other sources of water supply to which it is added. Most of the evidence brought forward in support of the belief that cholera outbreaks are cut short by the disinfection of the contaminated water supplies by the permanganate is furnished by hospital assistants, vaccinators, and others more or less untrained in scientific methods of observation. Unless there is reasonable proof that this chemical is entitled to the credit given it of destroying the cholera poison in sources of drinking water, its routine employment may not only be useless but may do harm by withdrawing attention from more important measures for providing and permanently protecting pure water supplies. Moreover, until it has been conclusively shown that the permanganate produces the results claimed for it, the scanty resources of district boards and municipalities might be better spent on sanitary improvements, which experience

has demonstrated to be effectual in diminishing the liability of villages and towns to disease of all kinds, including cholera. In connection with this question reference should be made to the report of the Inspector-General of Prisons of the United Provinces of Agra and Oudh for the year under report. As the result of an experiment conducted by a medical officer, under conditions calculated to exclude error, he arrived at the conclusion that the use of the permanganate of potash in disinfecting the water used by the prisoners in the Central Prison at Lucknow, during the recent cholera outbreak there, exercised no appreciable effect on the progress of the disease. The subject is more fully discussed in our *Memorandum* on the Report of the Sanitary Commissioner of Bengal.

4. The deaths from *small-pox* decreased from 830 in the previous year to 190, and was equal to a ratio of only ·07 of the population of the province. The diagram on page 2 of the Vaccination Report illustrates very effectively the protective influence of vaccination against death from small-pox. The use of lanolinated vaccine lymph during the year proved very successful. Whilst it was followed by as high a percentage of success as the fresh calf lymph in use during the preceding year, it cost less, and on account of the greater convenience with which it could be used, admitted of a reduction in the strength of the vaccination establishment. Each vaccinator was able, during the year, to perform by means of it as many as 2,867 operations.

5. The mortality from *fever* and *bowel complaints*, which had been excessive during 1900, fell much below the mean ratio of the previous five years.

6. The expenditure on *drainage* and *water supplies* by municipalities seems inconsiderable ; less than four thousand rupees on the former and less than seventeen thousand on the latter. But these sums have to be regarded relatively to the size of the province, which, in point of population, is less than a single one of several districts in Bengal, and of at least one district in the United Provinces of Agra and Oudh.

13th May, 1903.

No. 13.

Memorandum by the Army Sanitary Commission on the Administration Report of the Town of Calcutta for 1901-02.

During the year the Administration Departments of the Municipality were reorganized. The partition of the town into four districts, each with its own separate Health Department and Engineer Department, should facilitate closer supervision of sanitary details and admit of more prompt action being taken in remedying sanitary defects than when the town was dealt with as a whole. The charge of the conservancy of the town has been withdrawn from the Health and placed under the Engineer Department. Whether this change will conduce to greater efficiency remains to be seen. At first it is likely to lead to an increase of correspondence, and perhaps to occasional friction between the two Departments. A still more important change is made in the position which the Health Department is in future to hold relatively to the Building Department. "Under the new scheme the action of the Health Department is restricted to action in connection with existing nuisances." The expediency of such restriction is more than doubtful, if its purpose is to deprive the Health Officer of the opportunity of expressing, in his capacity of sanitary expert, an opinion regarding the sites chosen for new buildings, and the suitableness or unsuitableness of the buildings themselves for the purposes for which they are intended. To neglect of the repeated warnings and remonstrances of the Health Officer in the past is due in no small degree the necessity for demolishing at vast cost blocks of buildings now pronounced to be so insanitary as to be incapable of being effectually dealt with in any other way. Yet the paragraph defining the position of the Health Officer concludes in the following words :—"In the matter, however, of dealing with applications for sanction to erect or re-erect not only domestic buildings, but also privies, cattle-sheds, and stables, the new Building Department has full executive control." Fortunately, this decision has not escaped the notice of the Government. In the review of the report by the Lieutenant-Governor of Bengal we read :—"The Health Department is now altogether dissociated from the Building Department, and it is a question whether this is altogether desirable. It appears that the Health Department is restricted to independent action in connection with existing nuisances only, but special cases must sometimes arise where the opinion of the Health Officer would be valuable in regard to applications for new buildings. If it be the case, as stated in the report, that the insanitary condition of certain areas in Calcutta is due more to structural defects than to any other cause, the importance of intimate relations between the Building and Health Departments is obvious, and the Acting Lieutenant Governor feels no doubt that the matter will receive attention." Possibly, the interference of the Health Department might be considered by the Building Department to be occasionally somewhat meddlesome or obstructive ; and it might tend to lessen the need for such interference if type designs of buildings were prepared in concert with the Health Department, and if no buildings were erected which did not conform, in principle at least, with such designs. To ignore, or rather, to deliberately dispense with, the advice of the Health Officer regarding the erection of buildings would be to court in the future a repetition of the mistakes of the past.

2. A *birth-rate* of only 10·7 per *mille* of population was recorded. Even taking into account the disproportion between the sexes in the constitution of the Calcutta population, 562,596 males to 285,200 females, there can be no doubt that the real birth-rate is higher than that recorded. The division of the city into four districts, each with its own separate Health Department, will, it is

expected, lead to much-needed improvement in the registration of vital statistics. The *death-rate* recorded for the year under report was 38·1 per thousand of population; and this is described by the Health Officer as "abnormally high." It is, however, considerably lower than in the preceding year, when it was 43·5. Taking into account the constitution of the population of Calcutta, with its small proportion of infants, and high proportion of adult males, a very low death-rate might be expected; whereas, in spite of its supply of filtered drinking-water, its drainage system, still far from completion it must be allowed, and other sanitary advantages, its death-rate is far higher than that of the province of Bengal as a whole. The death-rate recorded for Bengal for the year under review was 31·04 against 38·2 for Calcutta; and this notwithstanding that the birth-rate recorded for the former was 38·57 as compared with only 10·7 in the latter.

3. To the death-rate of 38·2 for the year *plague* contributed 9·2 and *small-pox* 2·4. The number of deaths from plague shows a slight decrease as compared with that of the previous year, having been only 7,883 in the year under report against 8,354 in 1900. The number of deaths from small-pox, on the other hand, rose from 1,010 in the previous year to 2,097, and was not exceeded in any year since 1895. The mortality from *cholera* and *fever* was, in the case of each of these diseases, less than that recorded in the previous year, and also less than the mean of the preceding decade. Any facts which might add to our knowledge of *enteric fever*, the most fatal of all the diseases to which European soldiers in India are subject, deserve to be recorded. During the year under review 23 deaths from this disease were registered in Calcutta; but unfortunately it is not stated whether all, or any, of these occurred amongst the native population. Many of the cases, it is added, were verified by Widal's agglutination test, but the specific bacillus was not found in the town water, and though sanitary defects were present in the surroundings of several of the cases, there was no sufficient evidence to establish with anything like certainty the source of the infection. The most remarkable point connected with this brief notice of the disease is the smallness of the number of deaths attributed to it in a total of 32,450 deaths from all causes and in a population exceeding three-quarters of a million.

4. Consequent upon the partition of the town into four districts, the Vaccination Department has been abolished. The old vaccinators have been replaced by Hospital Assistants working directly under the orders of the Health Officers. The numbers vaccinated during the year were the largest ever recorded except in 1895; and the percentage of successful cases in primary vaccination was 98·3. But it is too early to judge of the improvement in the work of vaccination which is expected to result from the changes mentioned. That there was room for improvement in the administration of the Vaccination Department may be deduced from an examination of Table No. XII., in the Appendix to the Report. After all, the ultimate test of the value of vaccination is its success in preventing small-pox Applying this test to Calcutta, it will be seen from the table referred to, that during the 16 years preceding 1895 the deaths from small-pox never reached a thousand in any one year, and that they were fewer than a hundred in nine of those 16 years, whereas during the past seven years the small-pox deaths recorded in one of them were more than a thousand, and in each of two others more than two thousand. Without attaching too much importance to such statistics, it is undeniable that in recent years Calcutta has suffered more severely from small-pox than during any period between the great epidemic of 1865 and the epidemic of 1895.

5. The Report bears testimony to increased energy on the part of the authorities in their endeavour to ameliorate the insanitary conditions acknowledged to be in large part responsible for the high death-rate of Calcutta. The difficult task of effectually draining the town is being worked out at immense cost; and the question of the best way of converting the present intermittent water-supply into a continuous supply is under consideration. Fortunately, so far as the quality of the filtered water supplied to the town is concerned, the Health Officer is able to report that this "compares very favourably with that of the largest towns of Europe." But "the lamentable state of the drainage in the suburban area, the unhealthiness of the locality and the high death-rate undeniably point to the urgent need for action." The presence of plague has directed increased attention to the need for demolishing insanitary dwellings and carrying out "bustee" improvements. The demolition of insanitary huts and the clearing, or opening out, of overcrowded areas lead, however, to other difficulties. The displaced inhabitants of these huts and areas have to be compensated for disturbance and provided with suitable dwellings elsewhere. None too soon, intramural burials have been prohibited in the interest of the public health, and a number of cemeteries and burial grounds closed by the order of Government. Altogether, it is evident that a determined effort is being made to grapple with the insanitary conditions to which the high death-rate of Calcutta is known to be in great part due.

No. 14.

Memorandum by the Army Sanitary Commission on the Administration Report of the Madras Municipality for 1901–02.

The calendar year 1901 was, throughout, a very unhealthy one. Except in December, the temperature was above the average during every month, and the rainfall exceeded the average by 10·82 inches. Humidity was above the average in all of the months except March, May, and June. In conjunction with other conditions unfavourable to health, the dearness of the staple food (grains) it is said "tended to affect the vitality of the poorer classes, and to lessen their power of resistance to disease."

2. The *birth-rate* fell from 40·5 in the previous year to 37·0. These rates are calculated in the case of both years on the new census figures of 1901. The birth-rate of the previous year, calculated on the census figures of 1891, was 45·6, another illustration of the wide divergence in the ratios of vital statistics which may result from continuing to calculate them on the population numbers of the previous census instead of on the population as altered by natural increase, immigration, emigration, &c., in the course of the succeeding years. And yet this error would not have been got rid of by using the population numbers estimated by annually adding to or subtracting from them the excess or deficit of births as compared with deaths, or by assuming that the increase or decrease would proceed at the same rate as during the preceding intercensal ten years. Had the former of these two methods been used for calculating the population of Madras city for 1900, the result would have been that the figures of the census of 1891 would have shown a reduction of 4,409, the births registered since last census having been fewer than the deaths registered during the same period by that number. But the numbering of the people showed that not only was there no such decrease, but that the population of 1900 exceeded the population of 1891 by 56,879 persons. Had the latter, and ordinary, one of the two methods of estimating the population been adopted a nearer approximation to its actual number would have been attained, the increase between the taking of the census of 1881 and that of 1891 having amounted to 46,670 as compared with 56,879 between the census of 1891 and that just taken.

3. The *death-rate*, calculated, as in the case of the birth-rate, on the census population numbers of 1901, rose to 55·0 from 41·1 similarly calculated for the preceding year. The census numbers for 1891 having been used in calculating ratios in 1900, the death-rate recorded in the report for the latter year was 46·2. The explanation given of the difference between the birth-rate recorded for 1900 in the report for that year and its birth-rate calculated in the present report for comparison with the rate for 1901 applies equally to its death-rate. The increased death-rate for the year under report was due to greater mortality from all the chief diseases except measles.

4. *Cholera* was present in the city during every month of the year, and was simultaneously prevalent in the surrounding villages. Quoting from the report :—" It has always been a discussion whether these villages were the means of introducing cholera into the city or *vice versa*." Probably the same cause, or causes, which were accountable for the development and propagation of the disease in the city co existed and produced similar results in the surrounding country. This has been remarked with regard to other diseases. During years of unusual fever prevalence in towns, such, for example, as Calcutta, it has frequently been observed that the surrounding country suffers simultaneously, and to nearly the same degree. Except that it was more severe, the cholera epidemic of the year under report " ran identically the same course almost in every detail " as in 1900. In both years the greatest number of attacks occurred at exactly the same period of the year almost to a day, namely, from the 16th of August to the 26th of September. This coincidence, it is observed, " more than ever proves the close relationship the epidemic bears to seasonal influences." There seems to be no doubt that the mortality caused by cholera in the city was much greater than the returns would indicate. As always happens in India, when those discovered to be suffering from the disease are removed from their homes to hospitals, much concealment of cases follows to avoid such removal, and the disinfection of the houses in which attacks have occurred. To such an extent has this concealment of cases of cholera been carried in many towns that it has been found expedient not to insist on the removal of the sick from their houses to isolation hospitals, but to treat them as far as practicable in their own homes. Unsatisfactory as the latter method of dealing with those suffering from cholera must necessarily be, it may be a question whether it is not preferable to the forcible removal of the sick to hospitals when such action has the effect of arousing the opposition of the people, who, by a system of passive resistance and concealment of the sick, are able to defeat the best efforts of the authorities to arrest the progress of the epidemic by isolating the infected from the healthy. Regarding the effect produced on the epidemic by well-disinfection, the following remark is made :—" As a preventive measure early in the outbreak wholesale hankinization of wells in certain localities was tried without any great obvious benefit." This experience coincides with that recorded by the Inspector-General of Prisons, United Provinces, in his Report for 1901.

5. *Small-pox* was accountable for 292 deaths, or a ratio of 0·5, per thousand of population. This, although the highest ratio recorded in the decennium, cannot be regarded as excessive. Vaccination, as shown by its history during the present and past years, is efficiently carried out, and to this the city of Madras doubtless owes the comparative lowness of its mortality from small-pox during a year of epidemic prevalence of the disease. The bye-laws relating to vaccination are not here allowed to become a dead letter, as they are in some places. No fewer than 821 prosecutions took place in consequence of neglect to obtain vaccination. In 618 of these cases vaccination was effected, whilst in the other remaining cases the majority had left the town, or vaccination had to be postponed on account of illness. In paragraph 132 the percentage of success is calculated on the combined results in primary vaccination and re-vaccination. But, as the better the quality of primary vaccination the lower will be the percentage of success in re-vaccination, the paradoxical result follows that the percentage of success will be lower in the combined result in proportion as the quality of the primary vaccination is higher. In Statement No. I, Appendix IV, the percentage of success is shown separately for primary vaccination and re-vaccination ; in the former this is recorded to be 98·96, and in the latter 70·59. By far the greater number of cases were vaccinated direct from calf to arm. In those cases the percentage of successful operations recorded was 89·34. The highest percentage of success followed the use of glycerinated lymph, and the lowest, 72·88, resulted from vaccination with lanoline lymph. Hitherto calf-to-arm vaccination has usually given better results than vaccination with glycerinated lymph.

6. The mortality from *fever* was the highest ever recorded in the city, and is said to have been " largely determined by the insanitary conditions which obtain in Madras, viz., over-crowded and ill-drained houses in undrained areas, with an insufficiency of food."

7. The "passport system," vigilantly carried out, has been attended with remarkable success in excluding *plague* from Madras. Whilst the other Presidency cities and many of the large towns throughout India have been severely visited by plague, Madras has hitherto enjoyed almost complete immunity. During the year under report no indigenous case occurred although five cases were imported, two of which proved fatal.

8. In former reports the chief sanitary wants of Madras city have been stated to be the completion of its drainage system, and the improvement of its water supply. To these should be added the opening out of the "congested and foul *parcheries* of Black Town and other densely populated quarters." The completion of the drainage works is to take precedence of the improvement of the water supply. Regarding the quality of the water during the year under report, it is stated that the Chemical Examiner found it to be satisfactory except during the four months July—October, when it was reported to be "suspicious." Reference to the returns of cholera shows that during three of those four months the disease was most prevalent and fatal. The excessive sickness and mortality of the year under report, due in great part, as they are acknowledged to have been, to well-known insanitary conditions, will doubtless stimulate the municipal authorities to increased effort to hasten the removal of those conditions

---

No. 15.

MEMORANDUM by the ARMY SANITARY COMMISSION on the ADMINISTRATION REPORT of the MUNICIPAL COMMISSIONER of the CITY of BOMBAY for the year 1901–02.

The Annual Report of the Executive Health Officer is written by Dr. J. A. Turner, who was in charge throughout the year. The report is brief, but comprehensive. Following it is a short account of the working of the Municipal Hospital for Infectious Diseases at Arthur Road, by the Special Assistant Health Officer, Dr. Chosky. The latter, in addition to his other work, undertook, but has not yet completed, an inquiry into the character and type of the relapsing fever which has been prevalent in Bombay for several years past.

2. The mortality, which had steadily grown since the plague first appeared towards the end of 1896, at length showed a decided decrease in the year under report. This decrease was not due to any decline in the prevalence of plague, for this, on the contrary, was more fatal than in the previous year, but to an abatement in the severity of the cholera, small-pox and measles epidemics, from which the city suffered in the preceding year.

3. The improved system of registration of *births* and *deaths* introduced by the new Executive Health Officer has not yet had sufficient time to produce any very marked effect on the birth and death rates. The number of births registered was, however, greater than in the previous year by 832, the birth-rate rising to 17·42 from 15·43 in that year. The lowness of the birth-rate is undoubtedly in large part due to the disproportion in the numbers of the sexes in the City of Bombay ; there being to every 100 females 161·96 males. The improved system of registration has, so far, failed to show that there has hitherto been exaggeration in the recorded number of still-births. Last year the number of these registered was 2,062 ; and this year the number has risen to 2,153 against 13,520 children born alive. This abnormally high proportion of still to live births has always been a feature of the vital statistics of Bombay, and still awaits a satisfactory explanation.

4. The *death-rate* which had risen in 1900 to 96·56 per thousand of population, fell in the year under report to 76·66 ; but was still above the average for the past five years. The mortality amongst the infant population, usually regarded as a reliable measure of the healthiness or unhealthiness of a locality, was enormous. Whilst the number of live-births registered during 1901 was 13,520, the number of children who died within their first year of life was 7,768 or 574·5 per thousand.

5. Chief among the causes of death was *plague*, which of itself accounted for a death-rate of 24·14 out of a total from all causes of 76·66. The disease was of a very virulent type, the mortality in hospitals varying from 79 to 91 per cent. The Health Officer has little that is new to say regarding it. The experience, he says, gained during the past years in its prevention and treatment shows that overcrowding, poverty and insanitary conditions contribute to its spread ; whilst nothing can be more evident than that fresh air, sunlight, and improved sanitary surroundings have an opposite effect. Experience and observation of these facts seem to be, at length, convincing the inhabitants that their best hope of safety lies in the evacuation of their crowded and insanitary dwellings and movement into camp. It is stated that 13,000 persons were received in the municipal camps during the plague epidemic of 1901, and that the percentage of deaths in these camps was only 0·56. Besides these, about 25,000 people removed of their own accord into the private camps on the sea-face and in the north of the island. It would thus appear that the plague-stricken inhabitants of the cities of the plains are tardily realising the value of the method of dealing with plague which has long been successfully practised by villagers in the Himalayas. From such voluntary action on the part of the people themselves more is to be hoped than from all the elaborate and costly measures which the State can bring into operation in the endeavour to circumscribe or stamp out the disease amongst a population so numerous, so ignorant and superstitious as that of India.

6. The decline in the mortality from *cholera, small-pox*, and *measles* was marked. Together, these diseases accounted for 8,791 deaths in the previous year, and in the year under report for only 424. A table is inserted in the Health Officer's report recording, but without comment, the results of the season's vaccination operations. From this table it appears that, of a total of 12,945 primary vaccine operations which were successful, 11,202 were performed on children under one year of age. Seeing that, as already noted, only 13,520 live births were registered during 1901, and that 7,768 children died within their first year, it is evident that few, if any, of those born in the city could have escaped vaccination. But in Bombay the exogenous element so largely preponderates in the population that no certain deduction can be drawn from these figures. If the number of people who were not born in, but had immigrated into, the City of Bombay may be estimated from the number of deaths of persons who died there but were born elsewhere, the indigenous element forms but a comparatively small proportion of the total population. According to the statement in paragraph 29 of the Health Officer's report, of a total of 59,495 persons whose deaths were registered in the city during the year, only 13,064, or less than one fourth, were born there. From which it may be assumed that Bombay city depends more upon immigration than upon reproduction within itself for the recruitment and maintenance of its population numbers.

7. *Phthisis and respiratory diseases* had, as usual, a large share in the causation of the mortality for the year. Under these headings no fewer than 14,320 deaths were registered, giving a death-rate per *mille* of population of 18·44. The causes of the enormous mortality from phthisis in Bombay city are well known. Although females are in the proportion of only 100 to 161·96 males in the population, the deaths from phthisis among the former numbered 3,355 as compared with 3,161 among the latter. The remarkable differences in the incidence of this disease in the different sections of the city are well shown in the statements on page 159, and may be taken as some measure of the comparative unhealthiness of the several sections

8. A total of 7,921 deaths was registered from *fevers* of all kinds. Of this number over seven thousand were ascribed to the remittent type ; but, as the Health Officer observes, a careful diagnosis might have ascertained that many of these were due to relapsing fever or to plague. An examination of the returns month by month shows that the fever mortality rose and fell with the mortality from plague. It is interesting to note that of the total number of deaths attributed to fevers of all types, only 62 were ascribed to enteric fever. Unfortunately, the number of these cases which occurred amongst Europeans and Eurasians and the number among natives are not separately stated ; but assuming that all of them occurred amongst the seven hundred thousand natives of Bombay—and this unlikely—it is another proof of the comparative immunity from this type of fever enjoyed by the latter. Dr. Chosky, in his remarks on relapsing fever, notices the frequent concurrence of this disease with phthisis. This concurrence he found to much enhance its fatality ; when uncomplicated, the mortality from relapsing fever, so far as his investigations have yet gone, is, he says, "comparatively low."

9. A description is given of the more serious of the defects inherent in the site of the city. To these are due in a large measure the difficulties encountered in devising and carrying out an efficient system of drainage. But, "until a complete system for the removal and disposal of sewage and storm-water has been provided which will at once remove all sewage matter out of the city, any improvement in public health will necessarily be slow." Of hardly less importance than drainage is the proper housing of the working classes. "Much has been written about the conditions under which these poor people live—the overcrowding, poverty, and filthy surroundings, the dark, damp, ill-ventilated rooms have been commented on in many previous reports—but little has actually been done to relieve them." The influence of such conditions in accentuating the prevalence of plague is manifest in the cold weather when the people are obliged to sleep indoors.

REPORT

ON

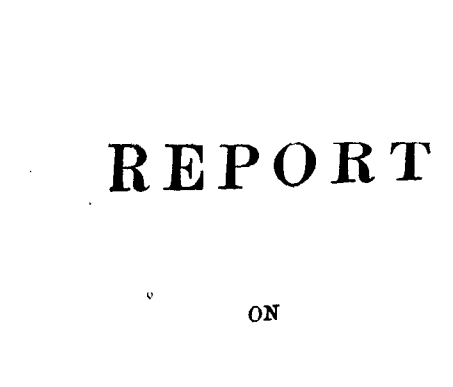
SANITARY MEASURES IN INDIA

IN

1902-1903.

VOL. XXXVI.

Presented to both Houses of Parliament by Command of His Majesty.



LIBRARY
OF THE
ROYAL
BOMBAY
BRANCH
OF TH

LONDON:
PRINTED FOR HIS MAJESTY'S STATIONERY OFFICE,
By DARLING & SON, Ltd., 34-40, Bacon Street, E.

And to be purchased, either directly or through any Bookseller, from
EYRE & SPOTTISWOODE, East Harding Street, Fleet Street, E.C.,
and 32, Abingdon Street, Westminster, S.W.;
or OLIVER & BOYD, Edinburgh;
or E. PONSONBY, 116, Grafton Street, Dublin.

1904.

[~~Cd. 2289.~~] *Price* 1*s.* 6*d.*
[Cd 2298.]

CONTENTS.

REPORT.

PAGE

I. EUROPEAN ARMY:

Sickness and mortality in 1902 ... 5
In Commands. 5
In Groups of Stations 6
Cholera 6
Small-pox 6
Fevers 6
Bowel complaints 7
Abscess of the liver 7
Plague 7
Venereal diseases 7
Invaliding 7

II. NATIVE ARMY:

Sickness and mortality in 1902 ... 8
In Commands... 8
In Groups of Stations 9

III. GENERAL POPULATION:

Vital Statistics 10
Bengal 10
United Provinces of Agra and Oudh 11
Punjab... 12
North-West Frontier Province ... 13
Central Provinces 13
Burma 13
Assam 14
Madras... 14
Bombay 15
Berar 16

IV. JAILS:

Sickness and mortality in 1902 ... 17
Bengal 17
United Provinces of Agra and Oudh 18
Punjab... 18
North-West Frontier Province ... 18
Burma 18
Central Provinces 19
Assam 19
Madras... 19
Bombay 19
Berar 20

V. VACCINATION:

General results 21
Bengal 21
United Provinces of Agra and Oudh 22
Punjab... 22
North-West Frontier Province ... 22
Burma 22
Central Provinces 23

PAGE

V. VACCINATION—*continued*:

Assam 23
Madras... 23
Bombay 23
Berar 24

VI. MEDICAL INSTITUTIONS:

Civil Hospitals and Dispensaries:

Bengal 25
United Provinces of Agra and Oudh 26
Punjab... 26
North-West Frontier Province ... 27
Burma 27
Central Provinces 27
Assam 27
Madras... 28
Bombay 28
Berar 28

Lunatic Asylums:

Bengal 28
United Provinces of Agra and Oudh 29
Punjab... 29
Burma 29
Central Provinces 29
Assam 29
Madras... 29
Bombay 30

Medical Schools:

Bengal 30
United Provinces of Agra and Oudh 30
Punjab... 30
Madras... 31
Bombay 31

VII. SANITATION:

Civil:

Bengal 32
United Provinces of Agra and Oudh 32
Punjab... 32
North-West Frontier Province ... 33
Burma 33
Central Provinces 33
Assam 33
Madras... 33
Bombay 34
Berar 34

1625 Wt 4222 11/04 D & S 6 18309

ABSTRACTS.

	PAGE.
India Sanitary Report for 1902:	
Meteorology of the Year	37
European troops	38
Native troops	57
Jails	66
General population	71
History of chief diseases (including plague)	78
Vaccination	92
Sanitary works	99
General remarks	103
Madras Sanitary Report for 1902:	
General population	116
Chief diseases	118
Sanitary works	123
Bombay Sanitary Report for 1902:	
General population	126
Chief diseases (including plague)	128
Sanitary works	131
General remarks	132
Shipping and Health of the Port of Bombay	133
Calcutta Municipal Report for 1902–03	138
Calcutta Health Report for 1902	142
Madras Municipal Report for 1902–03	147
Bombay Municipal Report for 1902–03	152
Bombay Health Report for 1902	153

APPENDIX.

Memoranda by the Army Sanitary Commission on :—	
India Sanitary Report for 1902	157
Bengal Sanitary Report for 1902	160
United Provinces of Agra and Oudh Sanitary Report for 1902	162
Punjab Sanitary Report for 1902	163
North-West Frontier Province Sanitary Report for 1902	164
Burma Sanitary Report for 1902	165
Central Provinces Sanitary Report for 1902	167
Assam Sanitary Report for 1902	168
Rajputana Sanitary, Vaccination and Jail Report for 1900	169
Madras Sanitary Report for 1902	170
Bombay Sanitary Report for 1902	172
Hyderabad Assigned Districts Sanitary Report for 1902	173
Calcutta Municipal Report for 1902–03	174
Madras Municipal Report for 1902–03	176
Bombay Municipal Report for 1902–03	177

A. GODLEY,
Under Secretary of State for India.

INDIA OFFICE,
October, 1904.

REPORT.

The present Report on Sanitary Measures in India during the year 1902 is prepared for presentation to Parliament. It contains chapters on the health of the European and Native troops, on the health of prisoners in jails, and on the health of the general population ; it also contains chapters on vaccination, on medical institutions, including medical schools and lunatic asylums, and a chapter on sanitary works. Appended to the Report are abstracts of reports by the three principal Sanitary Commissioners in India, and memoranda by the Army Sanitary Commission in England reviewing the several Sanitary Reports for India.

I.—EUROPEAN ARMY.

Sickness and mortality in 1902.

The health of the European troops serving in India during the year 1902 was on the whole satisfactory ; the admission, daily sick and invaliding rates were slightly lower but the death-rate was higher. On an average strength of 60,540, the admissions into hospital were in the ratio of 1,078 per 1,000, against 1,104 in 1901, the daily sick-rate fell from 67 to 66, and the death-rate rose from 12·38 to 14·68. The invaliding ratio (37) was lower by 2 per 1,000, so that the total loss by death and invaliding was equal to 52 per 1,000, an increase of 1 per 1,000 on the previous year.

The following statement shows the relative extent of sickness and mortality among European troops in the four Commands during 1902 and the previous year :—

Commands.		Average Strength.	Ratio per 1,000 of Average Strength.				
			Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
Bengal	1901	19,000	980	62	12·95	37	50
	1902	17,765	1,063	71	15·31	36	51
Punjab	1901	16,431	1,090	63	12·90	38	51
	1902	15,036	1,050	62	14·07	35	49
Madras	1901	10,282	1,278	79	9·34	43	52
	1902	11,097	1,083	70	8·92	40	49
Bombay ...	1901	15,125	1,140	69	13·16	42	55
	1902	14,404	1,125	67	19·58	43	63
INDIA ...	1901	60,838	1,104	67	12·38	39	51
	1902	60,540	1,078	66	14·68	37	52

It will be seen from the above statement that Bombay was the most unhealthy of the four Commands, Bengal coming next, and both were more unhealthy than in the previous year. In regard to mortality, there was an improvement only in Madras, where the death-rate fell from 9·34 to 8·92.

The chief causes of sickness in the whole European Army were, as usual, ague and venereal diseases, the former yielding a ratio of 281 per 1,000 against 276 in 1901, and the latter 247 per 1,000 against 293. Forty-nine per cent. of the total sickness resulted from these two causes. Enteric fever, as usual, was the chief cause of mortality, the death-rate from it being 4·29, or nearly 1 per 1,000 higher than the ratio of the previous year. Twenty-nine per cent. of the total deaths were due to this cause.

Groups of stations.—The following table shows the sickness and mortality among the European troops according to groups :—

Groups.	Average Strength.	Ratio per 1,000 of Average Strength.		
		Admissions.	Daily Sick.	Deaths.
Burma Coast and Bay Islands	1,044	1,147	66	12·45
Burma Inland	1,631	1,426	91	11·65
Bengal and Orissa	1,809	1,234	70	24·32
Gangetic Plain and Chutia-Nagpur	5,454	1,076	75	14·30
Upper Sub-Himalayan	11,281	1,086	71	15·87
North-Western Frontier, Indus Valley, and North-Western Rajputana.	4,260	1,150	59	14·08
South-Eastern Rajputana, Central India, and Gujarat.	4,320	1,340	81	17·59
Deccan	8,594	1,144	71	13·73
Western Coast	1,593	742	56	21·34
Southern India	3,495	954	53	6·87
Hill Stations	8,324	873	57	13·33
Hill Convalescent Depôts and Sanitaria ...	3,229	1,152	76	18·27

Of the above 12 groups, seven returned a higher daily sick-rate than that for the European Army as a whole, and in five groups the death-rate was greater. The most unhealthy groups, judged by the daily sick-rate, were Burma Inland and Central India, with daily sick-rates of 91 and 81 per 1,000 respectively.

Of the stations with a strength of over 1,000, the highest death-rates were those of Colaba (24·96), Karachi (21·0), Quetta (19·26), Rawalpindi (18·93), Mhow (17·89), Umballa (17·27), Poona (16·50), Meerut (15·95), Sialkot (15·10), and Agra (14·72).

Cholera.—There was again very little cholera among the European troops, only 3 cases having been recorded during the year, against 12 cases in 1901. In both years all the cases were fatal.

Small-pox.—Among the whole of the European troops in India there were during the year under notice 23 cases of small-pox with four deaths. In the previous year there were 20 cases and three deaths.

Fevers.—From intermittent fever the admission-rate per 1,000 among the European troops was less than in 1901, viz., 247 against 293, but the death-rate rose from 0·36 in 1901 to 0·50 per 1,000.

Enteric fever was more prevalent than in the previous year. The admissions rose from 776 or 12·8 per 1,000 of strength to 1,012 or 16·7, and the deaths from 202 or 3·32 per 1,000 to 260 or 4·29. Of the four Commands Bombay recorded the highest mortality under this head, viz., 5·69, followed by the Punjab 5·05, Bengal 4·00, and Madras 1·71. Among the larger stations with an average strength of over 1,000, Sialkot returned a death-rate from this fever of 8·88, Meerut 8·70, Quetta 7·71, Mhow 7·53, Umballa 7·06, Lucknow 6·22, Colaba 6·05, Poona 5·85, Peshawar 5·54, and Rawalpindi 4·63. As usual, young and unacclimatised soldiers were the chief sufferers; among those from 20 to 25 years of age the death-rate was 7·06 per 1,000 against 4·91 in 1901, while among men between 25 and 30, and from 30 to 35 the mortality was 2·91 and 1·92 per 1,000 respectively. Among men of less than one year's residence in India the death-rate from this fever was 13·50 per 1,000, among men between one and two years 4·61, and among men between five and ten years' service 2·74 per 1,000. Of the total 260 deaths from enteric fever, nearly 60 per cent. occurred among men between the ages of 20–25, and 27 per cent. among men between the ages of 25–30.

Bowel Complaints.—The admissions from dysentery and diarrhœa among the European troops were in the ratio of 33 per 1,000 of strength, or 2 per 1,000 less than in 1901. The mortality from dysentery was in the ratio of 0·69 against 0·97 in the previous year, and from diarrhœa 0·05 against 0·02. Dysentery was most prevalent, as usual, in the Bengal-Orissa group, and as regards the Commands it was more prevalent and fatal among troops in the Bengal Command.

Abscess of the Liver.—From abscess of the liver there were 112 deaths, giving a ratio of 1·85 per 1,000 of strength, against 101 or 1·36 in 1901.

Plague.—There were only four cases of plague among the European troops, and one death, against three cases and one death in 1901.

Venereal Diseases.—Venereal diseases ranked first in the list of causes of admission to hospital, and first in the causes of invaliding. They were the cause of 26 per cent. of the total sickness during 1902, and of 13½ per cent. of the invaliding of the European Army of India. The admission-rate from venereal diseases per 1,000 of strength was 281·4, being 5·4 higher than in 1901, thus interrupting the steady yearly decrease which commenced with the year 1896. The slight increase is attributed chiefly to the arrival of a number of regiments or drafts of regiments from field service in South Africa. Of the four Commands, Madras returned the highest ratio, viz., 343·4 against 354·4 in 1901; Bengal followed with 299·4, against 258·8; Bombay 286·7, against 282·6; and the Punjab 217·5, against 229·1. The number of men constantly sick in hospital from these diseases was 1,431, against 1,416 in the previous year; and the average stay of a case in hospital was about 31 days. The deaths from these diseases numbered 15, and the invalidings 310, against 8 and 383 respectively in 1901.

Invaliding.—The loss to the whole European army by invaliding during 1902 amounted to 2,255 men, equal to 37·25 per 1,000 of strength, against 2,393 or 39·33 in 1901. The proportion of invalids to strength was highest in the Bombay Command (42·70), followed by Madras (40·37), Bengal (35·86), and the Punjab (35·50). As regards the influence of age and length of residence in India upon invaliding, 35 per cent. of the total number invalided were under 25 years of age, against 42 per cent. in 1901, while 17 per cent. against 14 were of less than two years' service, and 48 per cent. against 60 were of less than five years' service.

II.—NATIVE ARMY.

Sickness and Mortality in 1902.—The health of the Native Army of India was on the whole better than in 1901, though the death-rate was slightly higher.

The ratios of sickness and mortality among Native troops in the five Commands during 1902 and the previous year are given in the following table :—

Commands.		Average Strength.	Ratio per 1,000 of Average Strength.		
			Admissions.	Daily Sick.	Deaths.
Bengal	1901	26,200	667	27	8·44
	1902	26,652	629	25	8·03
Punjab	1901	46,050	944	30	12·03
	1902	43,486	746	27	12·76
Madras	1901	18,622	699	28	8·80
	1902	18,017	704	28	12·77
Bombay	1901	22,428	933	35	12·93
	1902	24,371	856	30	11·65
Hyderabad Contingent	1901	5,826	543	21	4·81
	1902	6,204	518	18	9·83
INDIA	1901	122,806	829	30	10·68
	1902	124,231	718	27	11·16

Of the five Commands, Bombay was again the most unhealthy in 1902, though its death-rate of 11·65 per 1,000 was exceeded by those of the Punjab and Madras Commands. Pneumonia continued very prevalent in the Punjab and Bombay Commands, and the death-rates from it were 5·70 and 4·39 per 1,000 respectively.

The chief cause of sickness in the Native Army was ague, which contributed 38 per cent. of the total admissions. Among the diseases from which the admissions to hospital were higher than in 1901 were small-pox, enteric fever, tubercle of the lungs and pneumonia ; while from influenza, cholera, respiratory diseases other than pneumonia, diarrhœa, and venereal disease there was a decrease in the admissions. From cholera the admission-rate fell from 0·3 per 1,000 of average strength in 1901 to 0·2, and from venereal diseases from 34·3 to 32·8, as compared with 281·4 per 1,000 among European troops. There were 9 deaths and 121 invalidings from venereal disease, against 15 deaths and 310 invalidings among European troops.

Pneumonia was as usual the chief cause of death in the Native Army, and contributed 33 per cent. of the total deaths, the death-rate being 3·71 per 1,000 of average strength, against 2·72 in 1901. From this disease the mortality among the Native soldiers was nearly four times as great as that among European troops (0·97 per 1,000). Fevers of all kinds were the cause of 17 per cent. of the total deaths, against 34 per cent. among the European troops. From ague, remittent and simple continued fevers, the deaths among the Native troops were in the ratio of 2·06 per 1,000, while among the European troops the proportion was 0·70. On the other hand, the death-rate from enteric fever among the Native troops was only 0·10 per 1,000, as compared with 4·29 among the European troops.

From cholera there were only 15 deaths in the Native Army, equal to 0·12 per 1,000 of strength, as compared with 19 or 0·15 in 1901.

During 1902 there were 192 cases of plague among the Native troops with 95 deaths, against 70 cases and 41 deaths in 1901.

Groups of stations.—The following statement gives the principal statistics of the Native Army, arranged in geographical groups, for 1902 :—

Groups.	Average Strength.	Ratio per 1,000 of Average Strength.		
		Admissions.	Daily Sick.	Deaths.
Burma Coast and Bay Islands	1,362	1,043	26	5·14
Burma, Inland	3,659	983	33	6·56
Assam	1,427	651	32	8·41
Bengal and Orissa	2,280	824	34	8·33
Gangetic Plain and Chutia-Nagpur	6,136	516	21	8·15
Upper Sub-Himalayan	14,978	636	23	9·15
North-Western Frontier, Indus Valley, and North-Western Rajputana.	16,472	901	32	12·81
South-Eastern Rajputana, Central India, and Gujarat.	10,754	898	33	12·55
Deccan	15,978	631	24	8·64
Western Coast	1,670	701	27	11·38
Southern India	6,270	728	32	22·33
Hill Stations	20,950	822	32	13·70

In seven of the 12 groups the daily sick-rate was higher than that for the whole Native Army, and in five the mortality was greater. The highest mortality was recorded by the Southern India group, viz., 22·33, of which pneumonia contributed 4·31. In 1901 this group returned a death-rate of 10·25.

Of the large stations with a strength of over 1,000, the following recorded the highest death-rates :—Bangalore 33·77, Dera Ismail Khan 23·65, Aurangabad 21·86, Meean Meer 20·27, Abbottabad 16·20, Ferozepore 14·42, and Quetta 12·37, in all of which, except Abbottabad and Quetta, pneumonia was the chief cause of death.

III.—GENERAL POPULATION.

The year 1902 was comparatively dry, the rainfall in India as a whole having been slightly below the annual mean.

Registration of vital statistics in the British provinces of India though improving is still very imperfect and defective, and the statistics must still be regarded as possessing only comparative value. In 1902 the birth-rates of the several provinces varied between 56·9 per 1,000 of population in Berar and 23·91 in Coorg, and the death-rates between 44·11 in the Punjab and 20·20 in Madras Presidency. Of the chief diseases cholera was less prevalent and the deaths fell from 271,210 in 1901 to 224,135. The North-West Frontier Province and Coorg were quite free from the disease, and in all the other provinces, except Bengal and Assam, the mortality was lower than in the previous year. The mortality from small-pox continued to rise, and accounted for 115,603 deaths, being an increase of 25,818 on the number recorded in 1901. From fevers also the number of deaths was somewhat larger than in the previous year, aggregating 4,291,952 or 60·5 per cent. of the total deaths. Deaths from dysentery and diarrhœa fell slightly from 248,287 to 236,869. Plague spread considerably during the year, and the deaths rose to 445,293, an increase of nearly 90 per cent. on the mortality in 1901. Of these 184,752 occurred in Bombay, the Punjab coming next with 171,302, followed by the United Provinces and Bengal with 40,223 and 32,967 deaths respectively.

The deaths from the chief diseases and from all causes in the several provinces were as follows :—

Provinces.	Cholera.		Small-pox.		Fevers.		Dysentery and Diarrhœa.		Plague.		Deaths from all causes.		
	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000. 1902.	Ratio per 1,000. 1901.
Bengal	150,971	2·02	57,430	0·77	1,721,921	23·13	56,995	0·76	32,967	0·44	2,488,428	33·43	31·04
United Provinces of Agra and Oudh.	25,160	0·53	4,976	0·10	1,169,102	24·51	27,915	0·58	40,223	0·84	1,552,046	32·54	30·30
Punjab	371	0·02	11,629	0·58	473,352	23·54	14,124	0·70	171,302	8·52	886,973	44·11	36·13
North-West Frontier Province.	—	—	1,081	0·54	37,663	18·92	647	0·33	4	—	48,624	24·43	19·16
Central Provinces ..	28	—	4,394	0·45	141,888	14·52	10,799	1·11	1,061	0·11	252,279	25·82	23·46
Lower Burma ..	1,844	0·33	1,565	0·28	49,162	8·86	7,213	1·30	1	—	117,386	21·16	21·74
Upper Burma ..	57	0·02	350	0·12	18,393	6·37	661	0·23	—	—	49,919	17·30	—
Coorg	—	—	19	0·11	4,116	22·79	106	0·59	—	—	4,887	27·06	36·49
Assam	12,658	2·40	6,673	1·26	77,679	14·72	11,213	2·13	—	—	153,070	29·01	27·85
Madras	29,769	0·8	24,967	0·7	277,689	7·7	36,633	1·01	10,795	0·3	732,437	20·2	21·3
Bombay	3,229	0·17	2,189	0·12	270,345	14·66	58,682	3·17	184,752	10·0	721,462	39·04	37·12
Berar	16	—	327	0·10	37,354	13·7	11,408	4·2	4,188	1·54	89,153	32·8	27·6
Ajmer Merwara ..	32	0·07	3	0·01	12,783	26·81	473	0·99	—	—	15,672	32·86	33·13
Total ..	224,135	1·01	115,603	0·52	4,291,952	19·17	236,869	1·06	445,293	2·0	7,112,336	31·49	29·46

Bengal.

In Bengal the health of the general population in the year 1902 was not good. The birth-rate rose from 38·57 per 1,000 of population in 1901 to 40·14, which was made up of district ratios ranging from 53·10 in Noakhali to 9·08 in the Sonthal Parganas. In 25 other districts the birth-rate exceeded 40 per 1,000. There was an increase of 178,004 deaths during the year, the number having risen from 2,310,424 to 2,488,428, and the death-rate from 31·04 to 33·43. The rise in mortality was chiefly due to the greater prevalence of fever and cholera, and to the fact that infantile mortality was much higher than in the preceding year. The highest district death-rate was 51·28 in Nadia, and in 18 other districts the provincial rate was exceeded.

Of the chief diseases cholera prevailed with greater severity than in the previous year and claimed 150,971 victims, or 2·02 per 1,000, against 110,753 or 1·48. No

district was absolutely free from the disease, and it prevailed in 11 per cent. of the villages against 9·3 per cent. As measures of prevention the disinfection of wells with permanganate of potash was carried on in 20 districts, and is said to have been attended with beneficial results. The results of anti-cholera inoculation were satisfactory. Out of 106 inoculated coolies on board the steamer going from Goalanda to Dibrugarh there was only one case of cholera, which recovered; while out of 1,192 uninoculated coolies 18, or 1·51 per cent. were attacked, and four died.

The mortality from small-pox again rose from 37,680 or 0·50 per 1,000 of population to 57,430 or 0·77. The disease was present in all the districts, but it prevailed with the greatest intensity in Midnapore, Singhbhum, and Patna, which recorded death-rates of 6·39, 5·36, and 3·05 per 1,000 respectively, against 2·49, 1·32, and 0·51 during the preceding year. In the first and second of these three districts the epidemic apparently survived from the previous year, when the mortality was unusually high. On the whole the incidence of the disease was higher in 24 districts, lower in 21, and equal to that of the preceding year in one district. Out of the total small-pox deaths over 57 per cent. occurred amongst children under ten years of age.

About 69 per cent. of the total mortality was recorded under fever, the deaths numbering 1,721,921, or 23·13 per 1,000, being the highest ratio recorded since 1897. As regards the relative intensity of fever in each district, Nadia recorded the highest death-rate of 40·86 per 1,000, against 26·95 in the preceding year, and in eight other districts the death-rate was over 30 per 1,000 of their respective populations. In consequence of the greater prevalence of fever during the year there was a considerable increase in the demand for quinine, no less than 34,114 parcels of the drug (each parcel containing 102 five-grain pice packets) having been sold, against 30,593 parcels in 1901.

Deaths from dysentery and diarrhœa fell from 59,643 or 1·80 per 1,000, to 56,995 or 0·76. As compared with the previous year the incidence of these diseases was higher in 24 out of the 46 districts in the province. The mortality in towns was five times greater than in rural areas. "This," the Sanitary Commissioner remarks, "must continue to be so on account of the overcrowding and its attendant evils being more pronounced in towns than in the open country, and of the greater probability of the disease being correctly diagnosed and reported in the former."

Plague was present in the province throughout the year. It prevailed, however, with much less severity than in 1901, the mortality from it amounting to 32,967 or 0·44 per 1,000, against 78,629 or 1·05. Calcutta was the chief sufferer, with a death-rate from the disease of 8·58 per 1,000 of population, followed by Saran with a ratio of 5·68; Patna, which recorded a mortality of 16·86 in 1901, coming third with a ratio of 1·71. The same preventive measures continued in operation, viz., (1) disinfection; (2) evacuation of infected houses and localities; and (3) anti-plague inoculation; but the second measure was the only one in favour with the people. Inoculation was resorted to in three districts, but only a small number of operations was performed, the feeling of the people being against this form of protection.

The Municipality of Calcutta recorded a birth-rate of 14·2 and a death-rate of 37·0 per 1,000 of population. The high death-rate was attributed to the recurring epidemic of plague in the first half of the year. Excluding this factor the ratio is reduced to 28·4, which is only slightly above the mean of the decade (27·4). Cholera accounted for a larger number of deaths than usual, but the mortality from small-pox was comparatively low again after two bad years, and the deaths registered under fever were much below the mean. An important reform was introduced during the year, under which all cases of death that occur are inquired into by Sanitary Inspectors, nearly all of whom are qualified medical men. One result has been the detection of a considerable increase in the mortality from tuberculosis. The Health Officer attributes fully 10 per cent. of the total mortality of the city to this disease.

United Provinces of Agra and Oudh.

The health of the United Provinces of Agra and Oudh in 1902 was fairly satisfactory. Both birth and death rates were above the normal; but while the excess was slight as regards deaths it was very marked as regards births. The birth-rate was 45·84 per 1,000, being second highest among the provinces of India, and exceeded the death-rate by 13·30 per 1,000. All the districts except Naini Tal and Cawnpore returned birth-rates in excess of death-rates. The number of deaths recorded rose from 1,445,035 or 30·30 per 1,000 in 1901 to 1,552,046 or 32·54, which was composed of extremes varying from 49·50 in Cawnpore to 23·80 in Azamgarh. The high mortality in Cawnpore was due chiefly to a severe outbreak of plague, resulting in 9,753 deaths, or 7·75 per 1,000 of its population.

Cholera showed a further abatement in severity. The number of deaths from it (25,160) was less than a half of that (53,995) recorded in the previous year. The resulting death-rate was 0·53 per 1,000, which was exceeded in 19 districts, the highest being 2·32 in Banda. In five other districts the ratio was over one per 1,000.

Small-pox was considerably more fatal than in 1901, and visited every district except Garhwal and Mainpuri. Of the 4,976 deaths, all but 497 occurred among children under ten years of age.

Fevers contributed nearly three-fourths of the total mortality, the death-rate under this head being 24·51 per 1,000, against 23·46 in the previous year.

The mortality from dysentery and diarrhœa was much about the same as in the previous year, and the death-rate of 0·58 per 1,000 was made up of district ratios ranging from 8·13 in Garhwal to 0·02 in Bahraich and Kheri.

Plague largely increased during the year, and deaths to the number of 40,223 were recorded. These occurred in 34 of the 48 districts ; but in 14 the number was very small and the cases were almost all imported. The mortality was much higher among females than males, and this, the Sanitary Commissioner states, "may very possibly be due to the facts that native females spend far more time inside their houses and courtyards than men, and moreover, do not so habitually use shoes."

Punjab.

In the Punjab the recorded birth-rate rose from 35·4 per 1,000 of population in the previous year to 43·8, which is the third highest in the list of the provinces of India. In every district there was an increase, and in 11 out of the 27 districts the rise exceeded the provincial increase of 8·4 per 1,000. The death-rate of the province was 44·1 per 1,000, being higher than that recorded in any other province, and higher than the birth-rate by 0·3. The total registered mortality was 886,973, against 726,611 or 36·1 in 1901. The increase of eight per 1,000 in the death-rate was almost entirely due to plague, which prevailed with extreme virulence in the districts of Ludhiana, Sialkot, Umballa, Jullundur, Gurdaspur, Lahore, and Hoshiarpur, and accounted for their abnormally high death-rates, ranging from 103·9 to 41·7 per 1,000.

The province was again almost free from cholera, only 371 deaths being registered, against 180 in 1901. The disease was chiefly confined to the Delhi division, four districts of which returned 321 of the total deaths. An isolated outbreak occurred in a village in the Kangra district, Jullundur division. There were 65 seizures and 38 deaths, all of which occurred in one week. The origin of the outbreak is reported to have been due to the contamination of the drinking water of one of the village tanks by the washing of the soiled linen of a sepoy who had returned to the village from Burma suffering from diarrhœa on the way. On the inhabitants ceasing to use the water the tank was disinfected by permanganate of potassium, and "the cases ceased immediately."

Small-pox was much more prevalent than in the previous year, and the death-rate rose from 0·31 to 0·58 per 1,000. More than three-fourths of the total 11,629 deaths occurred amongst children under ten years of age. The disease was present in all the districts, but only in Montgomery did the death-rate exceed one per 1,000. Several of the towns in which vaccination is not compulsory suffered very severely, 10 recording death rates ranging from 11·83 to 5·12 per 1,000 ; while of the 22 towns in which the Vaccination Act is in force the highest recorded ratio was 1·6 per 1,000.

Deaths ascribed to fever fell from 508,035 or 25·3 per 1,000, to 473,352 or 23·54. The most striking feature of the returns for 1902 was the great prevalence of fevers in five out of the seven districts of the Delhi division, in which the fever death-rate ranged between 29·72 and 33·46 per 1,000, these being the highest district rates recorded during the year. In several districts the mortality under this head showed a remarkable decrease, notably in Ludhiana and Ferozepore, where the death-rates were less by 17 and 13 per 1,000 respectively.

The mortality from dysentery and diarrhœa was slightly less than in 1901, and the death-rate, 0·70 per 1,000, was exceeded only in nine districts, the highest being 1·57 in Simla and 1·49 in Gurdaspur.

Plague was very prevalent in the Province during the year, and the deaths rose from 14,959 to 171,302, giving a death-rate of 8·52 per 1,000. The epidemic was at its height in March and April, when 100,912 deaths, or three-fifths of the entire plague mortality, was recorded. The disease was chiefly confined to the central and thickly inhabited portion of the province, the greatest sufferer being the district of Ludhiana which lost during the year 71 per 1,000 of its population from plague. The ravages committed by the disease in some of the minor towns and villages in this district were terrible. In all the infected districts the epidemic with slight variations ran the same

course, increasing rapidly in the winter months, reaching its elimax in spring, and declining suddenly with the commencement of the hot weather.

North-West Frontier Province.

In the North-West Frontier Province the birth-rate was 33·6 per 1,000 of population, showing an increase of 4·1 as compared with 1901 ; but compared with other provinces the rate was the lowest with the exception of Madras, which it exceeded by 5·4 per 1,000. The excess of births over deaths was 9·2 per 1,000, and in no district did the death-rate exceed the birth-rate. The death-rate was 24·4, being 5·3 higher than in the preceding year. The increase was almost entirely due to fever from which there were more cases in all the districts, especially in Kohat and Bannu, the rate of mortality under this head being 18·92, against 14·62 in 1901. Over 77 per cent. of the total deaths were ascribed to fevers.

Cholera was entirely absent from the province during the year, and there were only four deaths registered under plague, all of which were imported from the Punjab. On the other hand the mortality from small-pox was slightly more fatal than in the previous year, the number of deaths having risen from 955 to 1,081. One-fourth of these occurred among infants under one year of age, and a little more than half among children over one and under ten years of age.

Central Provinces.

The year under report was a dry and healthy one in the Central Provinces, and there was no epidemic mortality except from small-pox in certain districts and some plague at the end of the year. The recorded birth-rate rose from 28·83 in 1901 to 48·29, which is the highest proportion of births to population since registration was begun, being mainly due to a return to normal conditions after a period of distress. All the districts registered a higher birth-rate than in the previous year, and in all the births exceeded the deaths, the excess for the province being 219,495 or 22·47 per 1,000. The mortality was rather higher than that recorded in 1901, the death-rate being 25·82 against 23·46. With the exception of four, all the districts returned a higher death-rate than in the previous year.

Cholera was again remarkably quiescent, only 28 deaths having been registered against 49 in 1901. Of the former, 26 were returned by Bilaspur, where the outbreak is supposed to have been due to importation by pilgrims returning from Puri.

Small-pox was accountable for 4,394 deaths or 0·45 per 1,000, a decrease of 1,687 on the previous year's mortality. The disease was less prevalent in all but six of the districts, and of those which returned a high death-rate Damoh came first with 1·86, but only in three other districts did the death-rate exceed 1 per 1,000. Seventy per cent. of the deaths occurred among children under ten years of age.

As usual fevers were the most fatal of all the diseases. More than half of the total mortality was registered under this head and the death-rate was slightly higher than in the previous year, viz., 14·52 against 14·28. All the districts except seven recorded a higher fever death-rate than in the previous year, but the increases were not considerable. The mortality due to dysentery and diarrhœa fell from 1·18 per 1,000 to 1·11. Half the districts recorded a higher mortality under this head than in the previous year, the increase in each case however was slight.

Plague was indigenous in the districts of Nimar, Burhanpur, Jubbulpore and Wardha, and the total mortality from it was 1,061. As in the previous year only two inspecting stations were in existence, viz., at Burhanpur and Wardha.

Burma.

Registration of vital statistics in Burma continues still to be limited almost entirely to Lower Burma, where a birth-rate of 31·57 per 1,000 of population was recorded, or 0·5 lower than that of 1901, the decrease to some extent being accounted for by lack of energy in the matter of inspection of registers. The births however exceeded the deaths by 10·4 per 1,000. From the 13 towns in Upper Burma in which births are registered a birth-rate of 38·07 was returned, against 37·66 in 1901.

The year 1902 was normally healthy. In Lower Burma the death-rate fell from 21·74 in 1901 to 21·16, a mortality which is considered too low, and can only be accepted as relatively correct for the sake of comparison. The district death-rate in Upper Burma was 17·30 per 1,000.

The province was much freer from cholera than in the previous year. In Lower Burma the deaths fell from 3,552 or 0·64 to 1,844 or 0·33 per 1,000, and in Upper Burma there were only 57 deaths from the disease. Four districts and 10 out of the 13 towns in Upper Burma returned no deaths from cholera.

Small-pox was also much less prevalent in Lower Burma, the deaths falling from 2,468 to 1,565. In Upper Burma the deaths numbered 350. Of the total deaths from this disease 47 per cent. were children under ten years of age.

The mortality from fevers in Lower Burma was slightly higher than that of the previous year, the death-rates being 8·86 and 8·65 respectively. In Upper Burma fevers were very prevalent, and 18,393 deaths were registered.

Dysentery and diarrhœa were less fatal in Lower Burma during the year, and the death-rate fell from 1·47 per 1,000 to 1·30. In Upper Burma the mortality under this head was 661.

The whole province again remained free from indigenous plague throughout the year, but three cases, imported from Calcutta, were detected at the port of Rangoon, one terminating fatally.

Assam.

In Assam the year 1902 was not quite so healthy as the preceding year. In the area under registration, with a population of 5¼ millions, the births represented a ratio of 34·21 per 1,000, against 33·98 in 1901. In the Surma Valley the birth-rate was 36·90 and in the Brahmaputra Valley 31·48. In both valleys there was an excess of births over deaths, that for the whole province amounting to 5·20 per 1,000. The mortality exceeded that of the previous year by over 6,000, and the death-rate rose from 27·85 to 29·01, which was made up of district ratios ranging from 35·72 in Darrang to 18·14 in Sibsagar.

Deaths from cholera showed an increase of over 5,000, the number having risen from 7,468 or 1·42 per 1000 to 12,658 or 2·40. The disease was very prevalent in the Surma Valley, the two districts of which (Cachar and Sylhet) contributed over 75 per cent. of the total cholera deaths. Sylhet district recorded 8,804 fatal cases against 2,805 in 1901.

Small-pox also showed an increased mortality of 3,400, which was chiefly due to several outbreaks in the districts of Cachar and Sylhet. In the former the mortality was more than 13 times as high as in last year, and twice as high in the latter, the increase being attributed to the dissemination of small-pox contagion by inoculators. Over 67 per cent. of the total 6,673 small-pox deaths occurred among children under ten years of age.

Although the rainfall was above the average in all districts except Lakhimpur, malaria was not nearly so prevalent as in the previous year, and there was a decrease in fever mortality. The death-rate from fevers, including *kala-azar* was 14·72 per 1,000 compared with 15·86 in 1901. The decrease in mortality was well marked in both valleys, but the districts of Darrang and Goalpara in the Brahmaputra Valley recorded the high rates of 25·71 and 27·54 per 1,000. About four-fifths of the total number of deaths in Goalpara were ascribed to fevers. Of the 77,679 deaths registered under fever 6,333 were from *kala-azar*. The disease was again very prevalent in Darrang and Nowgong, which returned 3,391 and 1,697 deaths respectively.

The death-rate from dysentery and diarrhœa fell from 2·19 to 2·13 per 1,000. There was the same remarkable differences in the rates of the various districts, ranging from 0·19 in Goalpara to 4·55 in Lakhimpur.

Madras.

In the Madras Presidency the year 1902 was one of good rainfall and reduced food prices, and was marked by an increased birth-rate and reduced mortality. There was an increase in the births of over 87,000 and the birth-rate rose from 25·1 per 1,000 to 28·2. Notwithstanding this improvement, registration of vital statistics is still far from accurate, and this is further shown in the large differences which appear in the ratios prevailing in neighbouring districts, *e.g.*, the birth-rate of 22·4 in North Arcot contrasts unfavourably with that of 31·1 in Chingleput. The mortality in 1902 was less by 63,703, the total number of registered deaths being 732,437 or 20·2 per 1,000 of population, against 21·3 in 1901. Ten of the 22 districts registered a death-rate in excess of the Presidency rate, the highest being 42·4 in Madras City, followed by 32·6 in Bellary and then 26 per 1,000 in Nilgiris, Tanjore and Tinnevelly.

The diminished rate of mortality is chiefly accounted for under cholera, from which the deaths fell from 81,370 or 2·2 per 1,000 to 29,769 or 0·8 per 1,000. This rate was exceeded only in six districts, and of these Bellary, Tinnevelly, Tanjore and South Arcot contributed 16,475 of the total cholera deaths, their respective rates being 3·2, 2·7, 2·2 and 1·2. As regards the influence upon cholera of protected public water supplies, the Sanitary Commissioner states that in the case of six towns which have been furnished with a

protected water-supply the death-rate from cholera has been reduced from a five year average of 4·1 per 1,000 to 1·8.

The incidence of small-pox was lighter than in the preceding year by 1,235 deaths, the death-rates being 0·7 and 0·8. The Sanitary Commissioner shows by a comparison of death-rates that during the last ten years good progress has been made in reducing the mortality from this disease, and the question of reorganizing the vaccination staff with a view to greater efficiency was under the consideration of the local Government. In the decade ending 1882 the small-pox mortality was 1·9 per 1,000, in that ending 1892, 1·4, and in that ending 1902, 0·3. Over 57 per cent. of the small-pox deaths registered in the year under notice occurred among children under ten years of age.

The deaths attributed to fever decreased from 294,854 or 7·90 per 1,000 to 277,689 or 7·7. The question of adopting measures for preventing the prevalence of malarial fevers in the Presidency has long been considered, but no appreciable progress has been made. "The prevalence of wet cultivation in the immediate neighbourhood of dwellings," the Government remark, "both in urban and rural tracts, and the heavy costs involved in putting an end to such cultivation, render the future prevention of malarial fevers far from hopeful, but a reduction in mortality may be hoped for from the extended use of quinine."

Dysentery and diarrhœa were also less fatal during the year, the number of deaths having fallen from 42,084 or 1·13 per 1,000 to 36,633 or 1·01. These diseases appear to be much more fatal in municipalities than in rural areas, the death-rate in the former being 4·5 per 1,000, against a rate of only 0·7 in the latter. In Madras municipality a death-rate of 6·7 was attributed to these diseases.

During the year 10,795 deaths from plague were registered, and of these 68 per cent. occurred in the district of Bellary. In the previous year 3,035 plague deaths were reported in the Presidency. In all cases the infection is said to have been imported from territories (chiefly Mysore) beyond the control of the Government of Madras. The Sanitary Commissioner remarks that "so long as Madras territory is liable to be repeatedly invaded from an area where no organization exists the chances of successful resistance to the general spread over the whole Presidency are much lessened."

The number of births registered in the Presidency of Bombay during 1902 was 631,393, giving a birth-rate of 34·16, which is a marked increase on the low rates obtained in the famine years of 1900 and 1901, viz., 26·87 and 25·19. Owing to the prevalence of plague the death-rate rose from 37·12 to 39·04, or nearly 5 per 1,000 in excess of the birth-rate. Eleven out of the 25 districts recorded a higher mortality than in the previous year, and in 13 districts the recorded death-rates exceeded the birth-rates.

There was comparatively little cholera in the Presidency during the year, only 3,229 fatal cases having been recorded against 13,600 in 1901 and 163,889 in 1900. Seven districts were entirely free, and six others practically so, as only one death was reported from each. The disease, however, was somewhat severe in Karachi and Hyderabad, where the death-rate reached 4·47 and 1·09 respectively.

The mortality from small-pox was less than half that recorded in 1901. There were only 2,189 deaths to which all the districts but five contributed. But only in one district (Kanara 1·32) did the death-rate reach 1 per 1,000. Sixty-five per cent. of the deaths occurred amongst children under ten years of age.

Fever was responsible for 270,845 deaths or 14·66 per 1,000, as compared with 291,951 or 15·80 in 1901. In the districts of Ahmedabad (39·50), Broach (26·05), Larkana (25·19), Kaira (20·60), Panch Mahals (20·33) and Thar and Parkar (19·75) high rates were again recorded, which is attributed to famine causes to a certain extent.

Dysentery and diarrhœa accounted for 58,682 deaths, or 1,516 more than in the previous year, the death-rate being 3·26. The highest district rate was recorded by Khandesh (8·12) followed by Sholapur (6·37) and in six others the Presidency rate was exceeded.

The mortality from plague during the year was the highest recorded since its first appearance in 1896. The fatal cases rose from 128,259 or 6·94 per 1,000 in 1901 to 184,752 or 10·0. All the districts except Upper Sind Frontier were affected. Those most affected were Satara (29·37), Dharwar (29·38), Belgaum (27·42), City of Bombay (18·13), Khandesh (17·58), Kaira (11·71), and Nasik (11·11). In the other districts the death-rate from plague varied from 8·89 in Poona to 0·01 in Larkana and Sukkur. The most fatal month was December, when 30,507 deaths were registered. Over 10 per cent. of the towns and villages were affected by the epidemic, against 6·10 per cent. in 1901.

Berar.

The year 1902 was generally a healthy one in Berar, and except for plague there was little or no epidemic disease. The prices of food grains were easier than in the previous year, and returning prosperity resulted in a large increase in the number of marriages, which must have influenced the birth-rate, as it reached the abnormally high figure of 56·9 per 1,000 of population, the highest recorded during the past 31 years. The increase was most marked in the Buldana and Wun districts, where the birth-rates reached 62·7 and 59·5 per 1,000 respectively. The rates of the remaining districts were somewhat lower than the provincial rate, but higher than the provincial rates of the preceding 31 years. The death-rate was 32·8 per 1,000, which, though higher than that of the previous year (27·6), was 13·9 less than the quinquennial mean.

Except for one small outbreak in a village in the Buldana district, the province enjoyed immunity from cholera during the year. The number of deaths was 16, or one less than in 1901. The disinfection of the drinking-water supply with permanganate of potash and fumigation of houses are said to have helped the speedy disappearance of the disease.

Small-pox accounted for 327 deaths, or 137 more than in the previous year. Of these, 179 were contributed by Buldana district and 82 by Ellichpur; 63 per cent. of the deaths occurred among children under 10 years of age.

The mortality ascribed to fevers was slightly lower than in the previous year, the death-rate being 13·7 per 1,000 against 13·9. From dysentery and diarrhœa also there was a trifling decrease in the death-rate, viz., from 4·4 to 4·2.

Plague gained a footing in the province during the year, and the epidemic resulted in 4,188 deaths, of which Akola district returned 1,639 and Buldana district 2,507. It was only after the disease had wrought havoc among them that the people would consent to the adoption of any measures for preventing it spreading. "Experience, however, has taught them that their only safety lay in vacating an infected village as soon as possible, and to this most of them now readily resort, with the happiest results."

IV.—JAILS.

Sickness and mortality in 1902.

The health of the jails of British India, which had shown improvement in the previous year, still further improved in 1902. On the whole there was much less sickness among the prisoners, and the only diseases with increased admission rates were tubercle of the lungs and enteric fever. The death-rate fell from 25·16 per 1,000 of average strength in 1901 to 22·48 in 1902. The three diseases, dysentery, tubercle of the lungs, and pneumonia, which caused more than half the deaths in the previous year, were again credited with 57 per cent. of the total deaths. There were only 24 deaths from cholera, against 106 in the previous year. From tubercle of the lungs the death-rate was the highest recorded during recent years, viz., 4·25 per 1,000 against an average for the ten years 1891–1900, of 2·98. Although plague was so widespread and fatal during the year there were only 20 deaths from the disease in the jails.

The following statement shows the sickness and mortality among all classes of prisoners in the jails and subsidiary jails of the various provinces for 1902 as compared with the previous year :—

Provinces.	1901. Ratio per 1,000 of Average Strength.			1902. Ratio per 1,000 of Average Strength.		
	Admissions.	Daily Sick.	Deaths.	Admissions.	Daily Sick.	Deaths.
Bengal	1,096	38	27·6	1,041	39	25·4
United Provinces of Agra and Oudh.	840	40	24·2	734	35	20·4
Punjab	1,253	38	26·9	1,137	35	25·0
North-West Frontier Province...	973	32	12·8	1,038	32	28·0
Burma	547	26	15·2	537	25	15·9
Central Provinces	867	28	27·5	972	32	24·8
Assam	1,029	42	24·5	857	39	29·9
Coorg	654	35	165·9	320	32	48·0
Madras	476	24	21·7	390	22	17·8
Bombay	964	34	35·0	682	28	28·2
Berar	676	21	24·9	784	18	17·9
India	882	34	25·2	793	32	22·5

Bengal.

Notwithstanding an increase in the jail population of Bengal during the year, and consequent overcrowding in some of the jails, the death-rate among all classes of prisoners (25·4 per 1,000) was lower than in any of the previous ten years except 1898 and 1899. The jail death-rate was considerably below that of the whole population (33·4), which is satisfactory "considering that a large proportion of the jail population must always be drawn from those classes whose vitality is considerably below the normal standard." Of the 40 district jails 21 showed a distinct improvement in health, and the death-rates of the central jails, with two exceptions, were very low. There were only nine cases of cholera, all fatal, among the prisoners. Five jails had only one case, and two jails had two cases each, "thus showing that the threatened outbreak was quickly grappled with and not permitted to spread." There was a considerable falling off in the mortality from dysentery, and one of the most satisfactory features of the year is that 20 jails had no deaths from this once most dreaded of all jail diseases. Next to dysentery, tubercle of the lungs, &c., and pneumonia were the most fatal diseases. In spite of the prevalence of plague in many districts the disease attacked only two jails, viz., Alipore jail, which

recorded five cases, three fatal, and Darbhanga, one fatal case. In both jails energetic measures were taken to prevent the disease spreading, and the outbreaks were over in a few days.

United Provinces of Agra and Oudh.

The health of the prisoners in the United Provinces of Agra and Oudh was exceptionally good during the year 1902. Among all classes of prisoners the daily average sick rate per 1,000 of average strength was 34·9 against 39·5 in the previous year, and the death-rate 20·4, which was the lowest recorded, with the exception of that for the year 1893. Of the 56 jails in the provinces there were no deaths in three, and in 12 out of 25 in which the mortality was higher than the provincial average, the death-rate did not exceed 25 per 1,000. In the previous year the health of the three district jails of Allahabad, Moradabad and Banda, with death-rates between 50 and 60 per 1,000, caused much anxiety, but there was a satisfactory improvement in 1902; and in the Bareilly, Fatehpur and Jaunpur district jails, which were formerly considered unhealthy, the mortality was below the provincial average. There was very little cholera among the prisoners, only 16 cases and 9 deaths having been recorded, against 47 cases and 32 deaths in 1901. Only the two central jails of Benares and Ghazipur were affected. The epidemic in the Benares prison, resulting in six deaths, was checked by the removal of the prisoners from the infected quarters into camp. Of other diseases, dysentery accounted for 133 deaths against 163 in 1901, tubercle of the lungs, &c., 92 against 106, and pneumonia 61 against 67. Isolation of dysentery and tubercle cases is reported to have been attended with good results in certain jails.

Punjab.

The standard of health among prisoners in the Punjab during 1902 was higher than in the previous year. The ratio of constantly sick declined from 38 to 35 per 1,000, and, notwithstanding that there was a rise of nearly 8 per 1,000 in the death-rate of the free population, the mortality of the jails decreased from 26·95 to 25·06. Out of 28 jails, there were no deaths in four, and in seven others the death-rate was well below the provincial average. Of the remaining 17 prisons, the death-rate was higher than the provincial average in 14. No cases of cholera occurred in any of the jails, and there was a considerable decline in the death-rate from dysentery. On the other hand, tubercle of the lungs, &c., continued to increase, but it is noteworthy that 30 of the deaths out of 57 under this head occurred amongst prisoners who were admitted in bad or indifferent health. Steps were being taken to prevent the spread of tuberculous disease by the provision of isolation wards, and improvements generally in jail accommodation. Pneumonia was also more fatal. The Inspector-General believes the incidence of this disease to be largely affected by the personal hygiene of prisoners, and he has urged all classes of jail officers to give the matter their personal attention. In spite of the wide-spread prevalence of plague throughout the province, only three deaths from the disease occurred among the convict population. The Inspector-General states: "The large share of immunity enjoyed is no doubt ascribable to the generally good sanitary state in which the jails are maintained and to the precautions taken by most officers to prevent the introduction of the disease among the prisoners."

North-West Frontier Province.

The general health of the prisoners in the North-West Frontier Province during 1902 was on the whole satisfactory. The average daily sick per 1,000 of strength was 32, exactly the same as in 1901, and the death-rate rose from 12·7 to 28·02, which was 3·60 above that of the free population. The higher mortality was mainly due to the bad health of prisoners on admission. Of the 32 who died, 16 were admitted into jail in bad or indifferent health, and six cases were described as accidental or coincidental, such as fracture of the skull, rupture of spleen, heat apoplexy, &c. There was no cholera, and only four deaths from tuberculous disease of the lungs. Malaria as usual figured largely in the causation of disease, but prophylactics were issued in the autumn months with satisfactory results.

Burma.

In Burma the health of the prison population was again satisfactory. The admission and constantly sick ratios were the lowest on record, but there was a slight rise in the death-rate, from 15·19 per 1,000 in 1901 to 15·88. There were no deaths in seven out of the 32 jails and in the European side of the Rangoon jail, and in nine others the mortality was below the provincial rate. There was a marked improvement in the Moulmein jail, which for years had been notoriously unhealthy, the death-rate having fallen to 21·44. For the first time in 10 years the Burma jails were free from cholera. Of the other chief diseases, malarial fevers and bowel complaints were the most prevalent, while

tuberculous diseases were the most fatal, the death-rate being nearly 4 per 1,000, or a fourth of the total mortality. Separate wards for the treatment of tubercular cases existed in 10 jails, and the question of the desirability of a separate tubercle jail was under consideration.

Central Provinces.

The health of the prisoners in the Central Provinces during 1902 was on the whole good. There was no overcrowding to any considerable extent. There was an increase in the admission and daily sick rates, which was partly due to greater liberality in the admission of sick men to hospital, but the mortality (24·82) was nearly 3 per 1,000 less. In five out of the 19 jails there were no deaths. Malarial fevers were the chief causes of sickness, while bowel diseases furnished the largest number of deaths. Of the total 20 deaths from dysentery, just a half occurred in Jubbulpore central jail. A special investigation was made into the sanitary conditions of this jail and the circumstances which had conduced to the high mortality of 1901. As a result a change in the diet has been effected and structural improvements were in progress. The death-rate at this jail fell from 49·70 in 1901 to 40·36. From tubercular diseases the deaths rose from nine to 15, and of these Jubbulpore contributed seven. The separate treatment of patients suffering from these diseases has been under consideration, and the construction of isolation wards in the three central jails was being undertaken. All the jails were free from cholera during the year.

Assam.

Though the prisoners of Assam had lower ratios of sickness than in the previous year, their mortality was higher, the excess being chiefly due to an outbreak of beri-beri at Gauhati, which occurred during the last four months of the year and occasioned six deaths, or half the total mortality in that jail. The daily average sick-rate fell from 41·8 in 1901 to 38·6 in 1902, the decrease being due to a marked decline in the ratio of admissions from dysentery and malarial fever, and the death-rate rose from 24·5 to 29·9. There was only one case of cholera, which occurred in the Silchar jail and terminated fatally. Special precautions were taken in the case of prisoners suffering from tubercle of the lungs. In only three of the jails was the average strength over 100, and these contributed 35 out of the total of 45 deaths. In 14 jails no deaths took place.

Madras.

A high standard of health was maintained throughout the year 1902 among the prisoners in the Madras Presidency. The death-rate was only 17·8 per 1,000 against 21·7 in the previous year, while the ratio per 1,000 of daily average sick (24·1) was the lowest recorded for several years. "These very satisfactory results" the Inspector-General states, "are in a great measure ascribable to the care and attention of Medical Officers and Superintendents and their personal supervision of all matters relating to diet, labour, and personal hygiene." In none of the seven central jails did the mortality exceed 30 per 1,000, and of the district jails only in Cuddalore and Tanjore and the Criminal Leper Ward, Madras, was this ratio exceeded. In the case of those jails where mortality was high, the cause was stated to have been the poor health of the prisoners on admission. All the jails enjoyed an immunity from cholera except the Palamcottah district jail, which returned three cases, all of which proved fatal. The disease was prevalent in the town and district at the time. The number of admissions to hospitals and of deaths from tubercular diseases declined. Tuberculous patients are treated separately; measures are taken for the thorough disinfection and destruction of their excreta; open air treatment is as far as possible enforced. Plans were under consideration for the provision of special wards. Plague was prevalent in the vicinity of several jails and was a constant source of anxiety, but only one prisoner was attacked, who eventually recovered.

Bombay

The health of the prisoners in the Bombay Presidency during the year 1902 was satisfactory. Overcrowding occurred in 9 out of the 15 jails, and was relieved by transfer, and by the use of tents, temporary sheds, workshops, &c. The daily average sick rate fell from 34 to 28 per 1,000 of average strength, and the death-rate rate from 35·0 to 28·2. Admissions to hospital for malarial fever were much fewer than in 1901, numbering only 1,928 against 4,340. The decline was most marked in the Central Prison, Yeraoda, where the cases fell from 2,709 to 468. During the year the Medical Officer of this jail instituted a quinine gang, to each of whom was given five grains once a week, and the diminution in admissions was ascribed to this treatment. There was only one case of cholera, and this occurred in the Thana Special Prison, and did not prove fatal. In the Sind gang the proportion of pneumonia deaths was again high.

Of the total 20 deaths which took place among the gang 14 were due to pneumonia. In connection with this disease new barracks with improved ventilation have been built. There was also much sickness and mortality from pneumonia in the Hyderabad Central Prison, but many of the men who developed the disease are reported to have previously suffered from scurvy. Plague occurred in five jails, the most in Bombay City, where there were 16 cases and 9 deaths out of a total of 24 cases and 12 deaths from the disease.

Berar.

The general health of the prison population of Berar in 1902 was satisfactory. The ratio per 1,000 of daily average sick was 18 against 21 in the previous year, and the death-rate 17·87 against 24·94. The sick were freely admitted into hospital, and the mortality was slightly below that of the general population. There was no cholera in any of the jails. Plague was prevalent during the year in the station and district of Buldana, but the disease was kept out of the jail. Precautionary measures were taken to guard against its introduction: all newly admitted men from infected localities were kept under observation and in segregation for 10 days, all the prisoners and the jail establishment were inoculated, and the mouths and outlets of drains were so fixed as to prevent the ingress of rats. There was no overcrowding in the jails.

V.—VACCINATION.

General results.

During 1902-03 there were 8,431,564 persons vaccinated in the several provinces of India, being an increase of 395,120 on the number of the previous year. The increase was spread over all the provinces except the Punjab. Most progress was made in Bengal, the United Provinces and Bombay; and in several other provinces much more work was done than in the previous year. According to age, 3,707,644 children under one year of age, and 3,160,398 children between the ages of one and six years were successfully vaccinated during the year. The proportion of population protected against small-pox by the year's operations ranged from 58·4 in Coorg to 24·2 in Bombay Presidency. In the vaccination of infants the best results were obtained in Berar, the Central Provinces, Ajmer-Merwara, the Punjab, the North-West Frontier Province, and the United Provinces, and the worst in Burma and Coorg.

Statement showing the total number of persons successfully vaccinated during the year 1902–03 :—

Province.	Population among whom Vaccination was carried on.	Number of Persons vaccinated.	Ratio of successful Vaccinations per 1,000 of Population.	Number of Children successfully vaccinated.		Percentage of Annual estimated Births at 40 per 1,000 of Population successfully vaccinated.
				Under One Year of Age.	Between One and Six Years of Age.	
Bengal	74,764,424	2,781,972	37·21	894,791	1,462,913	29·92
United Provinces of Agra and Oudh.	47,960,667	1,665,253	33·17	942,065	486,086	49·11
Punjab	20,295,036	667,544	29·93	461,050	87,915	56·79
North-West Frontier Province	2,072,326	90,293	39·85	43,951	23,744	53·02
Burma	10,477,508	381,773	30·67	79,582	169,959	18·99
Central Provinces	11,873,029	464,051	37·30	301,934	71,737	63·58
Assam	6,126,343	304,121	48·18	69,787	189,423	28·48
Madras Presidency	38,227,818	1,332,209	30·61	382,079	577,222	24·99
Bombay Presidency	21,539,199	578,885	24·26	419,373	73,185	48·68
Berar	2,754,016	141,064	42·7	101,099	11,339	91·76
Coorg	180,607	11,407	58·42	983	5,448	13·61
Ajmer-Merwara	476,912	12,992	27·01	10,952	1,427	57·40
TOTAL	236,747,885	8,431,564	33·14	3,707,644	3,160,398	39·15

Bengal.

Satisfactory progress was made in vaccination work in the province of Bengal during the year 1902–3. The results show an increase of 119,146 operations over the number for the previous year, and a rise in the proportion of persons successfully vaccinated from 34·24 per thousand to 37·21. Out of the 49 districts in the province, including the Tributary States of Orissa and Chota Nagpur, there was an increase of vaccinations in 32 and a decrease in. 17. The increase in some districts was attributed to the prevalence of small-pox, and in others to the greater activity of the staff. It is estimated that 36·05 per cent. of the infants available for vaccination were protected during the year in the province as a whole, against 32·06 in the previous year. "There is thus," the Sanitary Commissioner remarks, "some improvement which must be gradual and slow, having regard to the fact that in most districts the people are very reluctant to have their children under one year vaccinated." Of the total 2,592,177 primary vaccinations,

214,764 were performed with calf lymph, 399,205 with lanoline lymph, and 1,978,208 by the arm to arm process, the ratio per cent. of success under each of these methods being 98·13, 96·75 and 98·38 respectively.

There was a considerable falling off in vaccination work in Calcutta, the total number of persons vaccinated (17,534) being less than half the number in the previous year (35,630). The decrease was partly due to the subsidence of small-pox, and partly to the district health officers and vaccinators being new to the work, and to constant changes in the Department, the vaccinators throwing up their appointments to take others which were more remunerative or congenial. In the two previous years, however, small-pox was prevalent, and special efforts were made to get people vaccinated, but making all due allowance the Health Officer considers the results very unsatisfactory.

United Provinces of Agra and Oudh.

In spite of the fact that plague was much more widespread in the United Provinces of Agra and Oudh during the year under report than in the preceding year, the number of persons vaccinated continued to rise and reached the total of 1,665,253, an increase of 85,058 on the figures of 1901–2, and of 73,266 in the number of successful primary vaccinations. The increase was spread over 37 of the 49 districts, the most conspicuous being Sitapur and Ballia with increases of 25,566 and 16,028 respectively. The percentage of successful primary cases in which the results were known rose slightly, from 97·71 to 97·90. Bovine lymph was very little used, only 21,065 operations being performed with it, with a percentage of success of 98·73. The Vaccination Act is in force in all municipalities and cantonments, but the rules are said to be enforced with a varying degree of energy in different places.

Punjab.

There was a slight falling off in the number of vaccinations performed in the Punjab during 1902–3, but it was entirely under re-vaccinations, as the primary operations rose from 511,121 in the previous year to 582,626. The greater part of the decrease occurred in the district of Kangra and the Simla Hill States where, although plague was not present, the people opposed vaccination, fearing that they would be subjected not to vaccination, but to anti-plague inoculation. As regards Kangra, the Sanitary Commissioner remarks, "re-vaccination has been so extensively performed in this district in previous years that there is no need for a large number to be done at present." Of the 555,608 successful primary vaccinations, nearly 85 per cent. were infants under one year of age. The Vaccination Act was not extended to any new town during the year. A comparison of the statistics of the large towns in which the Act is in force shows, the Sanitary Commissioner states, that in several a greater proportion of infants remained unvaccinated during the year. "The prevalence of plague," he says, "has doubtless interfered with the work, but the principal causes of the slow progress of vaccination in towns are the apathy of the people and the want of interest on the part of members of Municipal Committees."

North West Frontier Province.

Much improvement was made in vaccination work in the North-West Frontier Province during 1902–3, the total number of operations being 90,293 or 19,300 more than the previous year's total. Of these 82,352 were primary cases with a percentage of success of 93·54. The increase was spread over all the five districts of the province. Of the total successful primary vaccinations, 53 per cent. were infants under one year of age, and the number of persons successfully vaccinated per 1,000 of population was 39·85, against 29·92 in the previous year. Both animal and preserved vaseline lymph were used during the year, the former showing in primary cases a percentage of success of 93·4, and the latter of 89·47. Out of the ten municipal towns in the province, the Vaccination Act is in force only in two, viz., Dera Ismail Khan and Bannu. The question of extending the Act to Peshawur City, where the proportion of children vaccinated is lower than in any other town of importance in the province, was under consideration.

Burma

With an increase in the average number of vaccinators the operations in Burma rose from 360,224 to 381,773. The increase however was entirely in Upper Burma as in Lower Burma there was a falling off, which was attributed chiefly to the attitude of the people who have a predilection for inoculation. "They fully understand," it is reported, "that vaccination is not compulsory outside municipal limits, nor inoculation illegal, so that villages which willingly submitted to vaccination in past years now hold aloof altogether on one pretext or another." A closer supervision of the work of vaccinators and the infliction of punishments for false returns are also advanced as reasons for the decline. Primary vaccinations rose from 333,791 to 355,013, but the percentage of success

was lower than in the previous year, being 86·9 against 90·1. The protection of infants remained very backward in the province. Out of 308,583 successful vaccinations only 26 per cent. were operations on children under one year of age, and only 19 per cent. of the births estimated at 40 per 1,000 of the population were successfully vaccinated.

Central Provinces.

Good progress was made in vaccination work in the Central Provinces in 1902–3. The aggregate number of vaccinations reached 464,051, the percentage of success in primary operations being 97·13 and in re-vaccinations 85·14. All the districts except Narsinghpur and Nagpur showed an increase in primary vaccinations. In these two districts and in several other towns and villages the prevalence of plague interfered with vaccination, and but for this disturbing influence and the withdrawal of some vaccinators for plague duty, the record of the year would have been even more successful. In Bhandara, where excellent work was done, the increase amounted to 86 per cent., and in Wardha to 54 per cent. The increase was mainly due to the very high birth-rate of the year combined with the low infant mortality; but a contributory cause was the commendable activity shown by the vaccination staff in most districts. Of 357,679 children under one year available for vaccination (that is, the total births less deaths under one year in 1902–3) 79·37 per cent. were successfully vaccinated. The Vaccination Act was not extended to any additional town during the year, but steps were being taken to improve vaccination work in municipal towns where hitherto there has been no attempt to apply the provisions of the Act.

Assam.

Vaccination progresses steadily on the whole in Assam. The results of 1902–3 show an increase of 23,294 operations as compared with the previous year. The increase however was not general, as in Cachar there was a decrease of nearly 30 per cent. and a considerable falling off in Goalpara. Inoculation is still carried on, especially in Cachar and Sylhet where the people are averse to vaccination. The Deputy Commissioner of Cachar says: "I regret to have to state that in the interior of the district the people prefer inoculation, and I have no doubt that the chronic state of small-pox in the villages is mainly due to the existence of professional inoculators." The percentage of successful primary operations was 97·90 or almost the same as in the previous year. Vaccination of children under one year of age increased, but even with the progress made the figures fell far short of the registered births. In towns where the Vaccination Act is in force more than 80 per cent. of the children available for vaccination were protected. Good work continued to be done at the Animal Vaccine Depôt at Shillong. The quality of the lymph "was generally excellent throughout the year."

Madras.

The total number of vaccinations performed in the Madras Presidency during 1902–3 was 1,332,209, representing an increase of 7,103 cases as compared with the preceding year. The increase was entirely in local fund areas, as municipalities showed a decrease of 11,210, due to the prevalence of plague, the disappearance of small-pox, the neglect of re-vaccination and paucity of cases available. In six districts there was a decrease, the explanation for which in three cases was insufficiency of staff. The percentage of success remained almost stationary being 90·7 against 91·0 in the preceding year. There was an increase of 25,612 in the number of children under one year of age successfully vaccinated, but the total number represented only 25 per cent. of the estimated births. Vaccination is compulsory in all the municipalities, and in these an average of 67 per cent. of the available children were afforded protection, more than a half securing a ratio of 75 per cent. Compulsory vaccination was also in force in some village unions of a few districts throughout the year, but it is as yet too early to say anything about its effects. More than a third of the total operations were performed with animal lymph, giving a percentage of success of 87·4; but the best results were obtained as usual from calf to arm vaccination with a percentage of success of 98·5.

Bombay.

In the Bombay Presidency the number of operations, which had been falling in the two previous years, rose in the year under notice to 578,885, or 10 per cent. more than in 1901–2. Out of 537,744 persons primarily vaccinated 93·05 per cent. were successful. Exclusive of Native States and Aden, which are not under the supervision of the Vaccination Department, 364,513 infants, or 71·85 per cent. of the available children were successfully vaccinated. Animal and human lymph were used in the Presidency, and a few operations were performed by glycerinated lymph and lanoline paste. In the Gujarat registration district vaccination was carried on entirely by human lymph, and in the

Presidency circle this lymph was not used. The best results were obtained from human lymph, the ratios of success in the Registration districts ranging between 86·67 and 95·57 per cent. No inoculation was reported to have been practised anywhere during the year, and no instances were reported of any disease having been communicated through vaccination.

Berar.

Satisfactory progress was made in vaccination work in Berar during the year 1902–3. The results show an increase in primary cases of 35,263, and the percentage of successful primary vaccinations was 96·8, slightly higher than in the preceding year. The number of revaccination cases fell by 14,617, this large decrease being due to the vaccinators having to devote more time to primary work on account of the high birth-rate of the year. The Vaccination Act is in force in all the municipalities, but owing to severe epidemics of plague in three of them, the average proportion of infants successfully operated on fell by 10 per cent. The Sanitary Commissioner gives some striking figures showing the efficacy of vaccination in diminishing small-pox mortality in the province: the ratio of successful vaccinations per 1,000 of population has risen from 8·92, the mean of the five years ending 1872–3, to 35·54, the mean of the five years ending 1902–3, and the mortality from small-pox during the same periods has declined from 2·02 to 0·15 per 1,000.

VI.—MEDICAL INSTITUTIONS.

Civil Hospitals and Dispensaries.

The following comparative statement shows the number of hospitals and dispensaries under official control open in the several provinces of India during 1902 and the previous year, and the number of patients under treatment :—

Provinces, &c.		Number of Institutions.	Number of In-door Patients.	Number of Out-door Patients.	Total Number of Patients.
Bengal	1902	574	52,237	4,110,539	4,162,776
	1901	550	49,362	3,662,477	3,711,839
Calcutta and Howrah	1902	17	29,063	260,769	289,832
	1901	17	25,989	253,615	279,604
United Provinces of Agra and Oudh	1902	368	55,212	3,677,116	3,732,328
	1901	364	55,328	3,661,957	3,717,285
Punjab	1902	251	50,138	2,968,988	3,019,126
	1901	245	51,565	2,973,446	3,025,011
North-West Frontier Province ...	1902	37	7,624	514,135	521,759
	1901	29	6,750	449,874	456,624
Burma	1902	129	42,168	883,246	925,414
	1901	119	39,027	858,200	897,227
Central Provinces	1902	103	9,591	1,338,420	1,348,011
	1901	103	10,592	1,337,340	1,347,932
Assam	1902	128	6,683	814,648	821,331
	1901	125	6,539	728,143	734,682
Coorg	1902	7	1,071	43,633	44,704
	1901	6	1,373	42,426	43,799
Madras	1902	485	61,592	4,929,053	4,990,645
	1901	479	64,714	4,686,978	4,751,692
Bombay	1902	312	51,621	2,124,846	2,176,467
	1901	238	45,191	1,558,603	1,603,794
Berar	1902	48	5,780	373,721	379,501
	1901	48	5,943	384,078	390,021
TOTAL	1902	2,459	372,780	22,039,114	22,421,894
	1901	2,323	362,373	20,597,137	20,959,510

Bengal.

The number of dispensaries at work in Bengal outside Calcutta during 1902 was 24 in excess of that of the previous year, and the total number of patients treated rose by nearly half a million, or 12 per cent., the increase being chiefly in out-patients. "The large increase," the Inspector General states, "was no doubt influenced by the unhealthiness of the year, but at the same time the local officers report that it was greatly due to the growing popularity of the dispensaries which have now been improved in many respects." An encouraging feature in the returns is the increased popularity of the dispensaries among female patients who numbered 68,239 more than in 1901, which was greatly due to improved arrangements for their treatment. The attendance of children also increased by 129,582. There was an increase of patients under all the chief diseases except small pox ; cases of cholera rose from 8,143 to 11,626, and of malarial fever from 653,997 to 758,128. The death-rate amongst the in-patients was 104·7 per 1,000, against 106·7 in 1901. Plague patients (in and out) numbered only 1,064, although 32,967 deaths from the disease were reported in the province during the year. Another satisfactory feature in the working of these institutions is the continuous increase in the number of operations which rose from 157,377 to 171,647 ; of these 214, or 0·12 per cent., were fatal. Among the more important operations there were 3,203 cases of extraction of the lens.

The following statement shows the number of in-door and out-door patients treated in the several hospitals and dispensaries in Calcutta and Howrah during 1902 and the previous year :—

NAME OF INSTITUTION.	1901.				1902.			
	In-door Patients.	Out-door Patients.	Total Number of Patients.	Died per 1,000 of In-door Patients treated.	In-door Patients.	Out-door Patients.	Total Number of Patients.	Died per 1,000 of In-door Patients treated.
Medical College Hospital	4,751	37,282	42,033	138·9	5,447	39,764	45,211	144·1
Eden Hospital	1,414	2,370	3,784	70·0	1,636	3,403	5,039	78·2
Ezra Hospital..	209	—	209	28·7	230	—	230	43·4
Shama Charan Law Eye Hospital	649	11,532	12,181	—	690	10,935	11,625	1·4
Presidency General Hospital	2,506	1,213	3,719	56·2	2,974	1,333	4,307	56·8
Campbell Hospital	7,956	23,283	31,239	281·7	7,844	25,844	33,688	256·6
Police Hospital	2,982	—	2,982	10·3	3,799	—	3,799	10·0
Mayo Native Hospital	1,788	24,835	26,623	106·2	2,128	26,069	28,197	138·6
Chandney Hospital	329	43,293	43,622	36·4	335	45,025	45,360	50·7
Park Street Dispensary	—	26,991	26,991	—	—	26,811	26,811	—
Chitpur Dispensary	—	19,255	19,255	—	—	17,981	17,981	—
Sukea Street Dispensary	—	15,468	15,486	—	—	15,254	15,254	—
Dufferin Victoria Hospital	382	5,392	5,774	31·4	634	6,452	7,086	26·8
Sambu Nath Pandit Hospital	1,265	18,978	20,203	124·0	1,269	19,767	21,036	140·2
Kidderpore Municipal Dispensary	—	4,944	4,944	—	—	5,737	5,737	—
„ Dockyard „	—	5,935	5,935	—	—	4,032	4,032	—
Howrah General Hospital	1,798	12,844	14,642	241·9	2,077	12,362	14,439	242·6
GRAND TOTAL	25,989	253,615	279,604	153·1	29,063	260,769	289,832	142·9

At the various medical institutions in Calcutta there was an increase of 7,154 in out-door patients and of 3,074 in in-door patients, an advance which is considered satisfactory, as the public health of the city was better than in 1901. Of the increase of 10,228, nearly a half were women and children. The increase in in-patients was shared in by all the institutions which accommodate this class of patients except the Campbell Hospital, "in which the attendance is always highest in times of scarcity and great sickness." There was an increase of patients treated under nearly all the major heads of disease as compared with the previous year. The rise in cases of cholera from 442 to 647 corresponded with the greater prevalence of the disease in the town. Plague cases rose from 458 to 554. Among the in-patients there were 4,155 deaths, giving a ratio of 142·9 against 153·1 in 1901. The total number of operations performed during the year was 28,385, against 27,552 in 1901, and death resulted in 200 cases against 207.

United Provinces of Agra and Oudh.

There was an increase of four in the number of dispensaries at work in the United Provinces of Agra and Oudh during 1902, and of 15,043 in the number of patients. The increased attendance, however, was entirely in out-patients, as the in-patients were fewer than in the previous year by 116. Among the in-patients there were 2,420 deaths against 2,950, and the death-rate fell from 53·3 per 1,000 to 43·8. Of the diseases for which the patients were treated there were 1,069 cases of cholera, as compared with 2,449 in the previous year, and cases of malarial fever increased by 13,338. The number of surgical operations was 182,548, and of these 155,656 were successful and 359 were fatal. Among the operations, 5,567 were for cataract, with a percentage of success of nearly 88. In reviewing the Inspector-General's report the Government state: "No department of Government has better earned, or more fully won, the gratitude of the people than the medical department of these provinces. With very imperfect means it has achieved results which may not look great in the light of the latest achievements of science in the West, but which are really very remarkable, and which compare favourably with results in more than half the civilized world at the present time, and in England within the memory of men who are not yet old."

Punjab.

There was an increase of six in the number of hospitals and dispensaries at work in the Punjab during the year 1902, the total being 249. Of the 3,019,126 patients under

treatment, which is 5,885 less than the number treated in the previous year, 50,138 were in-patients, of whom 2,385, or 47·5 per 1,000, died, against a mortality of 2,344, or 45·4, in 1901. The number of in-patients was 2·7 per cent. less than in the previous year, the diminished attendance being partly attributed to the prevalence of plague. Of the total number of patients treated the largest falling off occurred among those treated for malarial fevers (decrease, 74,734 cases) and diseases of the lungs and respiratory organs (decrease, 9,001 cases), while there were very large increases in the attendance of patients for classes of disease whose prevalence does not vary so much with variations in the rainfall and temperature. The number of patients treated for eye diseases increased by 60,550, and for ulcers by 13,089. Only 24 cases of cholera were treated. In the number of surgical operations performed (153,408) there was an increase of 1,571, which is all the more satisfactory seeing that there was a falling off in in-door and out-door patients. Of the total operations 148,213 resulted in cure and 254 were fatal. There were 5,700 operations for cataract, and of these 4,683 were successful.

North-West Frontier Province.

Returns were received from 37 dispensaries in the North-West Frontier Province during the year 1902, and at these 521,759 patients were treated, being an increase of 65,135 on the attendance in the previous year. Of the 7,624 in-patients, 5,701 were cured and 336 died. There was only one case of cholera, but there was a slight increase of small-pox cases and a marked increase in cases of malarial fever, to which all the districts of the province contributed with the exception of Dera Ismail Khan, where the cases were less by 3,528. The total number of operations performed was 21,689, or 2,039 more than in 1901. The results showed 21,331 cases as cured and 61 deaths.

Burma.

A total of 129 hospitals and dispensaries under Government supervision were working in Burma during 1902 or ten more than in the previous year. At these 925,414 patients were treated, being an increase of 28,187 over the figures for 1901. Of the 42,168 in-door patients, more than three-fourths were returned as cured, and 2,663 or 63 per 1,000 died, a somewhat lower mortality than in the previous year. As usual malarial fevers headed the list of diseases for which patients sought treatment, next in order being ulcers, diseases of the eye, worms and diseases of the digestive system. Cholera was slightly more prevalent, and the cases rose from 250 to 278 ; there was also a small increase in cases of small-pox. During the year 669 cases of beri-beri were treated in the Rangoon General Hospital ; of these 382 were in-door patients, of whom 196 died. The number of surgical operations continued to increase, and in 1902 aggregated 22,410. Amongst the patients operated on 21,351 were cured and 144 died.

Central Provinces.

During the year 1902 there were 103 dispensaries at work in the Central Provinces, and at these the number of patients, both in-door and out-door was practically the same (1,348,000) as in the previous year. Considering the healthy character of the year and the disturbing prevalence of plague in several towns the maintenance of the attendance is evidence of the popularity of the institutions. In most of the dispensaries arrangements for the separation of male and female out-patients while being examined and prescribed for now exist ; but it is not always easy, the Administrative Medical Officer of the provinces says, to induce female patients to avail themselves of these arrangements. As regards the number of patients treated for different diseases, the most important variations as compared with 1901, were an increase of 28,530 under eye diseases, a decrease of 17,912 under malarial fevers and of 9,457 under skin diseases. The number of surgical operations performed was 33,802 but a large majority were of a trivial nature. Of the total, 32,821 were cured and 71 died. Cataract operations declined from 904 to 810.

Assam.

In the province of Assam there were 128 dispensaries open during 1902 or three more than in the previous year. There was a further large increase of 86,649 patients treated. The number of in-patients rose from 6,539 to 6,883, and of these 4,110 were cured and 738 died, giving a death-rate of 110·4 per 1,000 against 121·1 in 1901. It is stated that the people who attend the Assam institutions belong for the most part to the lowest classes of the population, and have recourse to the dispensaries for trifling ailments, and that in the Assam Valley, especially, little confidence in European methods of treatment is shown by the upper and middle classes. Of the various diseases for which the patients were treated the largest numbers were under skin diseases and malarial fever.

Cholera cases numbered 2,571, of which 2,142 were treated in the Sylhet district where the disease was very prevalent during the year. The total number of operations rose from 15,689 to 17,417; but these were mostly of a trivial character, and only 734 were important.

Madras. In the Madras Presidency six more dispensaries were at work than in the previous year, bringing the total up to 485. There was an increase of 242,075 out-patients, and a decrease of 3,122 in-patients, the cause of the latter being plague scare in a few places, and improvement in the general health of the population in others. Of the 61,592 in-patients more than half were cured and 4,321 or 70·2 per 1,000 died, against a death-rate of 91·8 in 1901. Ulcers and diseases of the skin, diseases of the digestive system, and diseases of the eye were the most common complaints treated. Cholera cases declined from 10,833 to 5,141. During the year 163,941 operations were performed, exceeding the number of the previous year by 12,246. The results show that 153,408 were cured and 356 died. Of the more important operations 1,495 were for extraction of lens.

Bombay. The number of medical institutions in Bombay Presidency rose to 312, an increase of 74 on the number at work in 1901. The patients treated increased by 572,673, of whom 6,430 were in-patients. Admissions for malarial fever, diseases of the eye and of the respiratory system, skin diseases, and ulcers rose considerably. Cholera cases fell from 430 to 356; small-pox cases were also less numerous. The number of patients admitted into the hospitals and subsequently found to be cases of plague was 701, of whom 368 died and the remainder were transferred to plague hospitals. Of the total 51,621 in-patients 34,442 were cured, and 6,483 or 126 per 1,000 died, against a mortality rate in the previous year of 106 per 1,000. The surgical operations performed during the year numbered 86,811 with a mortality of 436 or 0·50 per cent. Of the more important operations 879 were extraction of lens.

Berar. The number of hospitals and dispensaries at work in Berar during 1902 was 48, the same as in the previous year, but owing to the exceptionally healthy character of the year and the good physical condition of the people, the number of patients who sought relief fell by 10,520. In the districts of Buldana and Akola, however, the decrease was attributed to plague, which caused a scare and deterred the people from seeking medical aid. Of the 5,780 in-patients 4,757 were cured, and 362 or 63 per 1,000 died, a death-rate which compares favourably with that of 73 per 1,000 for the previous year. There was a noticeable increase in the number of fever and spleen cases. There were no cases of cholera and only 25 of small-pox, but the province generally was remarkably free from both these diseases during the year. The number of patients operated on was 12,413, and of these 12,255 were cured and 31 died.

Lunatic Asylums.

Bengal. At the six asylums in Bengal (viz., Bhowanipore, Dullunda, Dacca, Patna, Cuttack, and Berhampore) 1,289 lunatics, including 278 fresh admissions and re-admissions, were under treatment in 1902, being an increase of 95 on the number of the previous year. In the course of the year under notice 114 patients were discharged as cured, and 44 as improved or otherwise, and 96 died. Compared with the figures of 1901, the number discharged was more by 36, and the mortality more by 35. At the end of the year there were 1,033 persons still under detention, or 24 more than at the close of 1901. The general health of the lunatics was satisfactory during the year The number of admissions to hospital rose from 576 to 604; the average daily number of sick fell from 71 to 66; and the death-rate rose from 61·8 to 93·5 per 1,000 of average strength. There were only two cases of cholera against one in 1901. The majority of the lunatics who died were criminals most of whom were old chronic cases and had been resident in the asylums for years. The cause of insanity was traceable only in 46·4 per cent. of the admissions into the asylums, and 53 cases were ascribed to ganja smoking. The results of the working of dairy farms at the asylums were not so satisfactory as in the previous year. The dairy farms at Dullunda, Dacca and Berhampore continued to work well though they showed a total profit of only £44. The usefulness of the dairy farms, however, is not indicated so much in the profits as in the supply of pure milk and in the congenial work which they afford to the lunatics.

In the Bhowanipur Asylum, containing European and Eurasian patients, included in the above total, the inmates during 1902 numbered 58, or 10 more than in the previous year. Of this number 37 were under detention at the beginning of the year, and 21 were subsequently admitted. In the course of the year 16 patients were discharged, and 5 died, leaving 37 under confinement at the close of the year. As regards the health of the patients during the year, there were only 6 admissions to hospital, against 5 in the previous year. Phthisis was more common and caused four deaths.

United Provinces of Agra and Oudh.

The inmates of the four lunatic asylums (Agra, Bareilly, Benares, and Lucknow) in the United Provinces of Agra and Oudh in 1902 numbered 1,391, including 314 fresh admissions during the year, against 1,362 in 1901. Before the close of the year 183 patients were discharged, of whom 117 were reported as cured, and 72 died, leaving 1,137 under treatment at the end of the year. The cause of insanity was unknown in nearly half (660) the cases under treatment. The general health of the patients was good.

Punjab.

The new Central Lunatic Asylum for the province of the Punjab was opened on the 1st March, 1900, and within that month the patients from the old asylums at Lahore and Delhi were transferred to it, and the two institutions were permanently closed. The total number of lunatics in the Punjab lunatic asylum during 1902 was 627, including 148 fresh admissions, against 610 in 1901. At the end of the year the number was reduced to 503 by the discharge of 85 patients, and 39 deaths. The health of the inmates of the asylum was on the whole satisfactory: the daily average sick fell from 54 to 48 and the death-rate from 114·0 per 1,000 of average strength to 79·4. The cause of insanity was unknown in just over a half (333) of the cases under treatment.

Burma.

The Rangoon Asylum is the only one in the province of Burma, and has accommodation for 416 insanes. The maximum number confined on any one day was 425. During 1902 there were 532 patients in the asylum, including 111 fresh admissions, and the total was reduced at the close of the year to 415 by the discharge of 73 patients for different causes and the death of 44. As regards the general health of the inmates, the daily sick rose from 29 to 33, and the death-rate from 88·0 per 1,000 of average strength to 105·7. There was no epidemic sickness in the asylum during the year. The death-rate was influenced by the low state of health of the insanes on admission.

Central Provinces.

In the two asylums of the Central Provinces (Nagpur and Jubbulpore) there were 357 lunatics under treatment during 1902, an increase of 3 on the number in 1901. In the course of the year 27 patients were discharged as cured or otherwise and 13 died, leaving 317 still under treatment at the end of the year. At both asylums the health of the inmates was poor, partly owing to the after effects of the influenza which was prevalent in the previous year. Of the total 13 deaths, Nagpur recorded 7, being in the ratio of 45·9 per 1,000 of average strength, against 10 or 67·6 in 1901. At Jubbulpore there were 6 deaths, being in the ratio of 39·2 per 1,000, against 10 or 63·3 in 1901. Of the 317 patients under treatment at the end of the year the cause of insanity was unknown in 228 cases.

Assam.

There is only one lunatic asylum in the province of Assam, and this is situated in Tezpur. The total number of lunatics under treatment in the asylum during 1902 was 173, or 25 more than in the previous year. Of these, 43 were fresh admissions. At the close of the year the patients in the asylum were reduced to 154, 11 of the total number having been discharged, and 8 having died. The daily average sick was considerably in excess of the previous year, rising from 8 to 10, and the number of deaths rose from 5 or 41·9, per 1,000 of average strength to 8, or 56·0. The causes of insanity were unknown in 109 of the total cases under treatment.

Madras.

At the commencement of 1902 there were 568 patients under treatment in the three lunatic asylums (Madras, Vizagapatam, and Calicut) of the Madras Presidency. During the year 168 fresh cases were admitted, bringing the total population up to 736, or 22 more than the number in the preceding year. In the course of 1902 there were 117 cases of discharge, and of these 87 were cured or improved. The accommodation was ample, and there was no overcrowding in any of the asylums during the year. There was less sickness among the patients than in the previous year. The daily average sick fell from

61 to 48 and the deaths from 53 or 94·2 per 1,000 of average daily strength, to 45 or 77·6. There was no epidemic in any of the three asylums. The causes of insanity were unknown in 347 of the total 736 lunatics under treatment during the year.

Bombay. The total population of the seven lunatic asylums of the Bombay Presidency was 1,295, including 522 fresh admissions, against 1,069 in 1901. In the course of the year 425 patients were discharged, 86 of them as cured, and 73 died, leaving 797 under treatment at the close of the year. The health of the inmates continued to be satisfactory; the daily average sick fell from 41 to 38, and the death-rate, per 1,000 of average strength, from 100·0 to 90·0. Of the total of 1,295 lunatics, the causes of insanity were unknown in 525 cases.

Medical Schools.

The number of medical schools open in Bengal during 1902–03 was 11, or one more than in the previous year. The Medical College, Calcutta, and four of the medical schools are maintained by Government, the rest are unaided. The college is affiliated to the University, and prepares candidates for its various medical degrees. The four Government medical schools train pupils as Civil Hospital Assistants, and the five unaided schools follow their own standards for private practice.

The students of the Medical College are required to undergo three University examinations during their five years' study, viz., the Preliminary Scientific examination at the end of the second year, the first L.M.S. or the first M.B. examination at the end of the third year, and the second L.M.S. or second M.B. examination at the end of the fifth year. The total strength of the College at the end of the session 1902–03 was 555 (including 14 women), against 595 in the preceding year. As regards the examinations, 247 candidates were successful, or at the rate of 45·3 per cent., as compared with 44·6 per cent. in the previous year. Of the 247 successful candidates, 23 passed the Preliminary Scientific L.M.S. examination, 82 passed the first, and 64 the second L.M.S. examinations; 45 passed the Preliminary Scientific M.B. examination; 18 passed the first and two the second M.B. examinations. In the combined Preliminary Scientific and First L.M.S. examinations there were only three candidates, but none passed; and 11 passed the combined Preliminary Scientific and First M.B. examinations. There was one candidate for Honours in Medicine, who obtained Honours in the subjects of Medicine, Surgery and Midwifery; and one candidate out of three obtained the M.D. degree.

The average number of students attending the four Government Vernacular Medical Schools at Calcutta, Patna, Dacca and Cuttack was 670 (including 33 women). 111 pupils passed the final examination. One female pupil was successful from each of the Temple and the Orissa Medical Schools, while 50 per cent. of the female candidates passed from the Campbell Medical School, Calcutta.

United Provinces of Agra and Oudh. The number of pupils attending the Agra Medical School in 1902–03 was 244 (including 57 women), or two more than in the preceding year. The results of the examinations are reported to have been satisfactory. The pupils are carefully examined at the end of each year's work, and are not promoted to the next higher class unless they pass the annual examination of their class.

Punjab. The average attendance at the Lahore Medical College and School was more by 43 as compared with that of 1901–02, viz., 515 against 472. Of these 211 were in the College and 304 in the Medical School. The Local Government remark: "The greater recognition of the medical profession as offering a career in life is a welcome feature of the year." The results of the year's examinations show that for the Preliminary Scientific Examination 38 out of 54 candidates passed. In the first L.M.S. and M.B. examinations 25 candidates out of 28 passed, against 12 out of 19 in the previous year, and in the second L.M.S. and M.B. examinations 20 out of 39 passed, against 23 out of 50; in all 83 out of 122 or 68·0 per cent. were successful, as compared with 49 out of 96, or 51 per cent. in the previous year. In the final examination for the hospital assistant diploma 60 passed out of 92, which is a considerable improvement when compared with 28 passes out of 64 candidates in the previous year.

The Medical School for Christian women continues to make progress and to do good work at Ludhiana. The object of the institution is "to provide a thorough medical

training, under fully qualified Christian women, for those Christian women and girls who wish to prepare themselves for medical mission work." At the end of 1902 there were 49 students on the rolls, or five more than in the previous year ; of these 20 belonged to the Medical class, six to the Compounders' classes, 15 to the Nurses' classes and eight to the *dais*.

Madras.

The average number of students at the Madras Medical College (including the School Department) during 1902–03 was 566, of whom 29 were women students. Of the 140 students in the College Hospital Assistant Department, 78 candidates appeared for the final examination and 57 passed. For the various examinations in medicine 111 candidates entered and 64 passed, against 40 out of 81 in 1901. For the first, second, and final examinations for the Apothecary grade 65 candidates passed of whom 9 were women.

The only other medical schools at work during the year were the Vizagapatam School and the Tanjore Medical School. At these there were 10 and 13 pupils respectively on their rolls, all of whom were being prepared for the Hospital Assistants' Certificate. From the Tanjore School 9 candidates appeared for the final examination and 5 passed.

Bombay.

The attendance at the Grant Medical College, Bombay, rose from 569 in 1901–02 to 657 (including 46 women) in 1902–03. For the first University examination in medicine 187 candidates presented themselves, of whom 123 passed ; and for the second examination in medicine 81 passed out of 171 candidates. For the final examination for the degree of L.M.S there were 91 candidates, and of these 37 passed, five of whom were women.

The Government Medical Schools at Poona, Ahmedabad, and Hyderabad continued to work satisfactorily. The average number of students on the rolls was 230.

VII.—SANITATION.

Bengal.

In Calcutta the work of improving bustees, or clusters of native huts, was carried on mainly on the same lines as in previous years. Two hundred and twenty-eight huts were demolished during the year, thereby removing some of the most insanitary plague spots in the city. "In any scheme for a general improvement of the health of the city," the chairman of the municipality remarks, "the remodelling of bustees must occupy a foremost place. Over-crowding, want of air space, light and drains, and the absence of proper sanitary conveniences are the prominent faults in existing bustees, and these can be remedied only by wholesale measures. The provision of accommodation for the surplus population must accompany any properly devised scheme for the demolition of insanitary bustees." Progress was made in the extension of the filtered and unfiltered water-supply, and the wastage of sullage, though still considerable, has been greatly reduced. The total length of filtered water mains and services amounted to about $317\frac{1}{3}$ miles, and the total mileage of unfiltered water pipes was $172\frac{1}{4}$ miles, of which 14 miles were laid down during the year. The works in connection with the suburban drainage scheme were being carried out under eleven separate contracts, eight of which have been executed. A surface drainage scheme for the suburbs was in preparation.

The municipalities of the interior of Bengal spent £150,300 or 43·41 per cent. of their income, on sanitary works (original and recurring) during the financial year 1901-02, being an increase of £3,389 on the expenditure of the previous year. The increase was chiefly under conservancy, the expenditure having risen by £5,340. Various sanitary works were also undertaken or completed in towns and rural areas, by municipalities, district boards, the Government, and private individuals, at a total cost of over £70,000.

The Sanitary Board held only one meeting during the year, but continued to advise the Government and local bodies on the important sanitary projects of the year. Among these were schemes for the improvement of the water-supply, the drainage and the conservancy of various localities, but the work actually carried out was not of great importance. The Board also continued the inquiry into the septic tank system of sewage disposal. The system having passed beyond the experimental stage, sanction was given to the Muzaffarpur municipality to construct a septic tank.

United Provinces of Agra and Oudh.

No new sanitary project of any importance was undertaken during 1902 in the United Provinces of Agra and Oudh, but many improvements in various directions were carried out in the municipalities and smaller centres of population, the prevalence of plague having drawn increased attention to the necessity of such measures. Considerable progress was made towards efficiently draining the site and removing sullage water from the inhabited area in the larger centres of population.

Important drainage works were in course of construction at Allahabad, Cawnpore, Lucknow, Benares, Farrukhabad and Aligarh, and "should prove of great utility in improving the public health of the country." At several other places important projects in connection with drainage were either under consideration or actually sanctioned.

The Sanitary Board met five times in the course of the year, when, among other matters, projects and estimates amounting to about £73,000 for improving the sanitary condition of several municipalities in these provinces were considered. The estimates show an increase of 51 per cent. on those of the previous year.

Punjab.

In the Punjab, important works in connection with the water-supply and sanitation of several large towns were under construction in 1902. Chief among these were the Amritsar water-works, which was making good progress; the Simla sewerage extension works and drainage of the bazaars; extension of the Lahore water-works distribution system; water and drainage works at Lyallpur were put in hand and good progress was made with them; and at Ambala city the extra-mural portion of the drainage scheme was commenced, and was well advanced at the end of the year. The Delhi water-works were completed, and the city is now adequately supplied with pure water. The sale of manure by the municipal towns of the province realised £10,378 against £10,030 in the previous year. As regards rural sanitation, attention was given to the improvement of wells and sanitary conditions in villages. In several districts village sanitary note books have been introduced, and the system was to be extended.

The Sanitary Board held seven meetings during the year, at which several important schemes were approved and forwarded to the Local Government for sanction.

North-West Frontier Province.

No large sanitary work was undertaken during the year in the North-West Frontier Province. The water-supply of Peshawar city was maintained and extended, and a number of new surface drains have been constructed in the city and old ones repaired. At Kohat a new pipe line was constructed to bring drinking water from the springs at Bawana to the railway station, and at Bannu a large new well was in process of construction in the city. The work of cleaning and improving wells and tanks was continued throughout the province. So far the issue of village sanitary note books does not appear to have been attended with any success. Out of their total income of £34,478 the municipal towns spent nearly £9,000 on sanitation.

Central Provinces.

In the Central Provinces the most important sanitary works of the year were the increase of the storage capacity of the Ambajhari reservoir, which supplies Nagpur with water, and the completion of the Bhandara water-works. Want of funds made it impossible to carry out any large scheme of drainage in municipal towns, but in Nagpur and Jubbulpore some advance was made in the construction of roadside surface drains, while the improvement of the water supply at Chanda, Warora and Seoni was also undertaken. As regards rural areas, village sites were cleared and cleaned in the ordinary way, but special measures in the way of rural sanitation were deferred to the year 1903, in which a special grant has been allotted for the purpose. The new Central Provinces Village Sanitation Act came into force towards the close of the year, and the preparation of revised rules under it was undertaken.

The Sanitary Board met in thirteen stations during the year, but owing to want of funds the work under their direction was chiefly in connection with the construction and repairing of wells and the cleaning of village sites.

Assam.

No sanitary work of any special importance was undertaken during the year in Assam, nor was there any large provincial scheme under consideration. Useful work was, however, done by local boards in improving the water-supply in rural areas. The system of sanitary inspection books was kept up in certain villages, but in some cases continued neglect was shown with regard to the submission of these books, in others they were reported as useless and of no practical value, while in others they were regularly submitted.

The Sanitary Board held two meetings during the year, notes being exchanged at other times as requisite.

Burma.

The municipalities of Lower Burma spent 49 per cent. of their income, or 14 per cent. more than in the previous year, on sanitary works. The expenditure on water-supply was more than doubled. A substantial addition was made during the year to the water-supply of Rangoon by means of tube wells, and this fresh source of supply has, it is reported, enabled the municipality to discontinue the use of the Royal Lake water, which had repeatedly been condemned as unfit for drinking purposes. The Hlawga water-supply scheme was still in course of construction. Further progress was made in the important work of reclamation in East Rangoon, and several new blocks had been prepared for the use of the poor ejected from insanitary areas then or about to be reclaimed. The Moulmein water-supply scheme was well advanced at the close of the year, and a similar scheme for the town of Akyab was submitted to the Sanitary Board for approval. Steady progress was being made in the surface drainage of the town of Prome. On rural sanitation a sum of £11,563 was expended during the year from district cess funds, and of this amount 29 per cent. were spent on domestic cleansing.

The Sanitary Board met on three occasions during the year, to dispose of projects forwarded to them for opinion and advice. The Board were of opinion that the question of the drainage of Akyab town should take precedence of the water-supply project; and acting on this advice the municipality applied for the services of the Sanitary Engineer to carry out a combined water-supply and drainage scheme.

Madras.

In Madras city a sum of £22,500 was expended on sanitation during the year, and of this amount £8,400 were spent on the new drainage works. The water-supply was extended to certain parts of the city. The quantity supplied in the course of the year was nearly 3 per cent. greater than in the previous year.

As regards sanitation in other towns, the schemes for the water-supply of Cocanada and Vizagapatam, the construction of the Tiger Hill reservoir in Ootacamund and the extension of the water-supply in Trichinopoly were in progress. Water-supply

schemes for Guntur, Dindigul, and Coonoor, were under the consideration of the Madras Government at the close of the year. Rural sanitation consisted chiefly in conservancy measures.

The Sanitary Board carried out a considerable amount of work during the year. Plans and estimates for 123 sanitary works were scrutinised, amongst them being proposed water-supplies at Kodaikanal, Vellore, and Saidapet, and improvement in the water-supplies at Madura, Trichinopoly, and Adoni. Investigations were in progress in several other towns, and a scheme for the drainage of a portion of Madura town was under consideration. On the recommendation of the Board an estimate of £553 was sanctioned for experimental works, in view of ascertaining the most effective method of filtration of sewage, the experiment to be conducted in the vicinity of the Vaccine Institute, Guindy.

Bombay. In Bombay city good progress was made with the various drainage works ; and the acquisition of properties was taken in hand with a view to commence the subsoil and surface drainage of the lower parts of the city. Drainage connections were carried out for 530 houses, and several latrines and urinals were erected in different parts of the town. The various municipal water-works were maintained in a state of efficiency. During the year 405 water connections were made, and 274 were cut off, leaving a total at the end of the year of 20,683. The Tansa and Tulsi lakes were again well replenished by the rainfall.

The expenditure incurred on sanitation by the district municipalities and the Taluka local boards during the year was higher than that of the previous year, but the Sanitary Commissioner says that " real sanitary progress has been at a standstill for some years past." The cause is to be found in the plague epidemic, which shows no signs of abatement. " Very few of the towns in the Presidency," the Government remark, " have escaped severe outbreaks of plague, which have burdened many with heavy debts." No progress was made in the introduction of the Village Sanitation Act owing to the prevalence of famine and plague, which have absorbed the attention of district officers in recent years.

The Sanitary Board considered and tendered advice concerning schemes for improving the water-supply and drainage of various localities.

Berar. The municipalities of Berar spent 40 per cent. of their income on sanitation as compared with 36 per cent. in 1901. No large sanitary work was undertaken owing to want of funds, and in many of the municipal towns active enterprise was to a great extent paralysed by the presence of plague. Little was done in the way of rural sanitation apart from the clearing of village sites and the improvement, where possible, of the well-water supply. The District Sanitary Board met as usual once at each of the six head-quarter stations, to consider the action taken by local bodies on the recommendations of the Sanitary Commissioner, as contained in his inspection notes of past years on towns and villages.

INDIA OFFICE,
October, 1904.

ABSTRACTS

OF

SANITARY AND OTHER REPORTS

FOR

1902.

ABSTRACT OF THE REPORT OF THE SANITARY COMMISSIONER WITH THE GOVERNMENT OF INDIA, FOR 1902.

(*Surgeon-General Sir B. Franklin, K.C.I.E., M.D.*)

Meteorology of the Year.

Summary of the meteorological conditions of the year.—The following report on the meteorology of India has been kindly furnished by the Meteorological Department of the Government of India :—

The first two months of the year 1902 were unusually free from storms. There were no storms of the usual cold weather type, and the few depressions which were developed over Gujarat and thence advanced through the central parts of the country were feeble and exercised little influence on the weather. The principal features of the meteorology of these two months were abnormal dryness of the air, absence of cloud, very scanty rainfall, and a persistent excess of temperature. In March the weather changed and an unusually large number of depressions passed over Northern India. Notwithstanding this, the accompanying precipitation was in many parts of Northern India less than usual. In consequence the mean maximum temperature and the mean minimum temperature were in excess in all parts of India. The month's rainfall was only in excess in South India, the West Coast, the Gangetic Plain, and Chota Nagpur, Bengal, Orissa, the Burma Coast, and the Bay Islands. In all other parts it was in defect, and in the Deccan, East Rajputana, Central India, and Gujarat, there was actually or practically no rain throughout the month.

In the hot weather months of April and May the rainfall was generally more or less excessive over the Upper Sub-Himalayas. the Gangetic Plain, and North-East India, normal over the Burma Coast, and in defect elsewhere. In consequence the mean temperature was generally in defect over North-East India, more particularly in Central and North Bengal, the Gangetic Plain, and the hill and submontane districts of Upper India, and in excess elsewhere. The excess was greatest in Sind, where it was moderate to considerable. The monsoon rains proper set in on the South Konkan Coast on the 7th of June, spread feebly but rapidly inland and gave a series of thundershowers to Berar, the Central Provinces, and Central India between the 8th and 15th. A storm formed over the Arabian Sea on the 9th and 10th, and advancing northwards carried the monsoon rains to Kathiawar and Gujarat between the 12th and 16th, and to Sind between the 15th and 18th. Between the 17th and 29th the monsoon was very feeble over the Arabian Sea, so that the districts influenced by this branch of the current received usually light rainfall. In the Bay of Bengal a storm formed on the 11th and 12th and passed into East Bengal on the 15th bringing monsoon rainfall with it, but between the 21st and 27th the rainfall was light over North-East India. The month's rainfall was generally light except in the Punjab, Sind, East Bengal, and the Surma Valley. In consequence of this deficient rainfall the mean temperature was generally excessive except in parts of North-West and North-East India. The excess was greatest in the Central Provinces. The highest temperature recorded was 125° at Jacobabad on the 5th. In July the rainfall was approximately normal—except in the North-West Frontier districts, the Indus Valley, and North-West Rajputana, where only a quarter of the normal fall was received, and on the West Coast and in Bengal, where the fall was in moderate excess. The mean temperature was in defect both by day and night over the greater part of the United Provinces, North-East India, and Central and Upper Burma, and in excess elsewhere, the greatest excess being reported from the north-west, where it varied between 2° and 9°. In Gujarat and North Bombay the absolute maximum temperatures were in some cases higher than have been previously observed in July. There was a long break in the rains during the first seventeen days of August over North-West and Central India and the Deccan, and the only districts where the month's rainfall was excessive were Upper Burma, the greater part of North-East India, North Bombay, and the central and

eastern districts of Madras. Elsewhere the rainfall was in considerable defect. The mean temperature was higher than usual at practically all the plains stations, and the diurnal range of temperature was greater than usual. The thermometer rose to 116·6° at Jacobabad on the 1st. Five cyclonic storms occurred during the month of September. Hence there was almost daily rain, and the month's rainfall was in excess in practically all parts of the country. Owing to the cloudy rainy weather the day temperature was generally (and on some occasions largely) below the normal, while the night temperature exceeded the average. The diurnal range of temperature was hence low, and the mean temperature was, over the greater part of the country, less than usual. October was also a disturbed month, and the rainfall was heavier than usual over the greater part of the Peninsula and over the Punjab and adjoining parts of the United Provinces. The mean temperature was low over parts of Burma, Assam, the foot of the Himalayas, the Madras Coast, and South India, and was more or less excessive elsewhere. During November and December there was generally more rain than usual over the Peninsula and less than usual over Northern India. Temperature changed rapidly and considerably during this period, but for the whole time the variations from the normal were neither large nor important.

Both the maximum and minimum temperatures on the mean of the year were below the normal over the inland parts of Burma, Assam, Bengal, and Orissa, but were higher than usual elsewhere. The excess was greatest and about 1½° in the Indus Valley, Rajputana, Central India, Gujarat, and the Deccan, while the deficiency was greatest and about 1·0° in Assam.

Pressure on the mean of the year slightly exceeded the normal over Burma, Assam, Bengal, Orissa, the Deccan, and South India, and was in slight defect elsewhere. For the whole year the variation from the normal was + ·016, and both in February and October the variations from the normal were very large.

The relative humidity on the mean of the year was above the normal over South India, but was below in all other divisions. The two first months of the year were marked by excessive dryness almost everywhere.

The cloud amount was generally below the normal during January, March, June, and August, and varied irregularly from the normal in the remaining months. On the mean of the year there was a trifling excess over Bengal, Orissa, the Deccan, and South India, and a deficiency elsewhere.

The rainfall of the whole year was in excess over Assam, Bengal, and Orissa, the West Coast, and South India, but was in defect in all the remaining provinces. On the mean of the whole area the annual rainfall was 0·37″ in defect.

The rainfall was in general excess in September, but was more or less in defect in the other months, more particularly in January, February, June, and November.

European Troops.

Sickness and mortality in 1902.—The health of the European Army of India during 1902 was not quite so good as during the previous year, for though the admission rate, the constantly-sick rate, and the invaliding rate were all slightly lower than in 1901, the death-rate was considerably higher.

Years.	Average Strength.*	Ratio per 1,000 of Strength.				
		Admissions into Hospital.	Constantly Sick.	Deaths.	Invaliding.	Total Loss.
1896–1900... ...	66,974	1,339	86	17·08	33	50
1901	60,838	1,104	67	12·38	39	51
1902	60,540	1,078	66	14·68	37	52
1891–1900... ...	68,224	1,399	87	16·21	29	45

*The quinquennial and decennial ratios are, of course, worked on the total strength of the lustrum and decade respectively.

The chief causes of admission into hospital were venereal disease and ague. These diseases accounted for 26 per cent. and 23 per cent. respectively of the total number of admissions from all causes. The only diseases with increased admission rates as compared with 1901 were venereal disease and enteric fever. The admission rates on account of ague, simple continued fever, influenza, and respiratory diseases were considerably lower than in the previous year.

The chief causes of death were, as in 1901, enteric fever and abscess of the liver; the death-rates of both these diseases being higher than in the previons year. The death-rate on account of respiratory diseases was also increased. On the other hand the mortality from cholera, simple continued fever, and dysentery was diminished. Enteric fever accounted for 29 per cent. of the total number of deaths, and abscess of the liver for 13 per cent.

The chief causes of invaliding were, in order, secondary syphilis, debility, and ague.

Among the troops comprising the Delhi manœuvres and Durbar Force, the chief causes of admission into hospital were ague and venereal disease, ague accounting for 30 per cent. and venereal disease for 21 per cent. of the total number of admissions from all causes. Enteric fever was the chief cause of death among the troops of this force, accounting as it did for 56 per cent. of the total number of deaths.

Commands and Stations.—Bombay was the most unhealthy of the four commands, Bengal coming next, and both being more unhealthy than in 1901. The highest mortality from remittent fever, heatstroke and pneumonia occurred in the Punjab Command, and the highest from small-pox and ague in the Madras Command. Among stations of over 100 strength the highest death-rates were recorded at Barrackpore, Murree, Kakool, Naini Tal, Attock, and Fatehgarh. The death-rates recorded at all these stations except Barrackpore and Naini Tal, were higher than in the previous year. Abscess of the liver was the chief factor in the mortality at Barrackpore and Naini Tal, and enteric fever at Kakool. Among stations of over 1,000 strength the highest death-rates were recorded at Colaba and Kurrachee, enteric fever being the chief cause in the former station and circulatory diseases in the latter. The death-rate at both these stations was more than three times as high as in 1901.

Geographical groups.—The most unhealthy geographical groups in 1902 were Bengal-Orissa, Central India, and Burma Inland. The highest admission rates on account of simple continued fever, rheumatic fever, and venereal diseases were recorded among the troops in the Burma Coast group; the highest on account of ague among those in the Burma Inland group; the highest on account of influenza, cholera, remittent fever, dysentery, abscess of the liver, and congestion and inflammation of the liver among those in the Bengal-Orissa group; the highest on account of enteric fever and pneumonia among those in the Upper Sub-Himalaya group; the highest on account of small-pox among those in the Indus valley group; the highest on account of tubercle of the lungs and respiratory diseases other than pneumonia among those in the Hill Depôts group; the highest on account of diarrhœa and the lowest on account of venereal disease among those in the Hill Stations group; and the lowest on account of ague among those in the Western Coast group.

Influenza.—The admission rate on account of influenza, which had risen to 8·9 per 1,000 in 1901, fell to 1·8 per 1,000 in 1902. The decrease was general throughout the country, but it was most marked in the Madras and Punjab Commands. The admission rate was, however, as in 1901, highest in the Madras Command, that of the Bengal Command coming next. Among the groups, the Bengal-Orissa group (IV) had the highest admission ratio, the Hill Stations group (XII*a*) coming next, and the Southern India group (XI) third. As compared with 1901, group II was the only fresh one affected, and group VII escaped; in both years all the other groups recorded admissions. Twenty-one stations returned cases, as compared with thirty-three stations in 1901. The largest number of cases occurred at Chaubuttia, where a mild epidemic, causing 31 cases with one death, prevailed during March, April and May. This was the only death recorded under the heading of influenza during 1902. At the *post mortem* examination of the case both lungs showed signs of intense congestion with numerous patches of consolidation, and there were also signs of recent pleurisy on both sides.

The fact that influenza frequently escapes recognition not only in mild cases but even in fatal ones has been emphasized by Washbourn and Eyre. In the examination of

Ratios of Commands.

	Ratios per 1,000 of the Average Strength.				
	Bengal Command.	Punjab Command.	Madras Command.	Bombay Command.	India.*
I.—Strength	17,765	15,636	11,097	14,404	60,540
II.—Constantly-Sick-Rate of the Year	71·3	61·6	69·6	66·7	66·0
III.—Admission-Rate of the Year—					
Influenza	2·8	·4	3·5	·8	1·8
Cholera...	·2	—	—	—	·05
Small-pox	·3	·4	·4	·5	·4
Enteric fever	17·2	18·0	8·7	20·4	16·7
Intermittent fever	229·4	279·4	185·4	273·2	247·1
Remittent fever	8·9	9·7	5·0	2·4	6·7
Simple continued fever	13·1	8·4	15·1	21·6	14·0
Tubercle of the lungs	2·6	3·3	2·4	5·5	3·4
Pneumonia	3·0	10·2	2·4	5·6	5·9
Other respiratory diseases	21·2	25·3	18·8	21·8	22·5
Dysentery	26·1	13·9	20·6	17·4	20·4
Diarrhœa	15·9	14·6	4·8	11·6	12·9
Hepatic abscess	4·8	2·0	2·6	3·5	3·3
,, congestion and inflammation	14·4	15·6	14·1	17·4	15·1
Venereal diseases	299·4	217·5	343·4	286·7	281·4
All Causes	1,063·1	1,050·4	1,082·9	1,125·1	1,078·4
IV.—Death-Rate of the Year—					
Cholera...	·17	—	—	—	·05
Small-pox	·11	—	·18	—	·07
Enteric fever	4·00	5·05	1·71	5·69	4·29
Intermittent fever	·45	·38	·99	·35	·50
Remittent fever	·06	·32	·09	·28	·20
Simple continued fever	—	—	—	—	—
Heatstroke	·84	1·02	·45	·69	·76
Circulatory diseases	·62	·45	·54	2·57	1·01
Tubercle of the lungs	·73	·64	—	·90	·59
Pneumonia	·73	1·53	·27	1·18	·97
Other respiratory diseases	·17	·26	·18	·42	·25
Dysentery	·96	·70	·18	·83	·69
Diarrhœa	·06	—	—	·14	·05
Hepatic abscess	2·98	1·15	1·17	1·94	1·85
All Causes	15·31	14·07	8·92	19·58	14·68

* Including Delhi manœuvres and Durbar Force.

Ratios of Geographical Groups.

	RATIOS PER 1,000 OF THE AVERAGE STRENGTH.												
	I. Burma Coast and Bay Islands.	II. Burma Inland.	IV. Bengal and Orissa.	V. Gangetic Plain and Chutia Nagpur.	VI. Upper Sub-Himalaya.	VII. North-Western Frontier, Indus Valley, and North-Western Rajputana.	VIII. South-Eastern Rajputana, Central India and Gujarat.	IX. Deccan.	X. Western Coast.	XI. Southern India.	XII.*a*. Hill Stations.	XII.*b*. Hill Convalescent Depôts and Sanitoria.	India.
I.—STRENGTH	1,044	1,631	1,809	5,454	11,281	4,260	4,320	8,594	1,593	3,495	8,324	3,229	60,540
II.—CONSTANTLY-SICK-RATE OF THE YEAR	65·9	90·6	70·3	74·9	70·5	59·2	80·7	71·3	55·7	53·2	57·0	75·9	66·0
III.—ADMISSION-RATE OF THE YEAR:													
Influenza	3·8	3·7	5·0	·9	·5	—	1·2	1·5	1·3	4·0	4·1	2·5	1·8
Cholera	—	—	·6	·4	—	—	—	—	—	—	—	—	0·5
Small-pox	—	·6	—	·6	·6	·7	·2	·3	—	·6	·4	—	·4
Enteric fever	3·8	4·3	9·4	19·6	21·7	10·6	18·3	18·5	5·0	9·4	20·8	19·5	16·7
Intermittent fever	151·3	528·5	259·8	230·8	302·3	385·9	437·5	236·7	105·5	114·4	107·8	228·6	247·1
Remittent fever	7·7	1·8	54·7	3·5	7·5	8·0	4·2	3·6	7·5	2·9	5·4	8·7	6·7
Simple continued fever ..	32·6	5·5	·6	12·8	14·7	5·6	20·8	15·4	7·5	12·0	18·9	6·8	14·0
Rheumatic fever	1·9	—	1·1	·4	·7	·2	·5	·6	—	·3	·8	1·2	·6
Tubercle of the lungs ..	2·9	2·5	3·3	3·5	3·5	3·5	2·5	2·8	2·5	1·1	2·2	3·7	3·4
Pneumonia	—	1·2	2·8	2·4	9·0	5·9	3·7	2·3	6·9	4·0	6·4	6·2	5·9
Other respiratory diseases	22·0	17·8	27·1	22·9	20·8	24·2	22·9	18·6	11·9	15·2	24·0	30·7	22·5
Dysentery	42·1	22·1	74·6	20·4	15·3	14·6	16·2	18·3	9·4	13·7	17·7	26·0	20·4
Diarrhœa	7·7	4·9	12·7	18·7	11·4	6·6	11·6	9·4	3·1	4·9	23·4	15·2	12·9
Hepatic { abscess	4·8	·6	17·1	2·9	1·7	3·1	2·8	3·3	1·9	2·6	2·6	6·8	3·3
Hepatic { congestion and inflammation.	10·5	14·1	27·1	13·8	15·8	18·1	15·3	13·4	15·7	10·3	14·7	21·7	15·1
Venereal diseases	431·0	281·4	413·5	287·5	243·6	243·2	346·8	371·5	260·5	348·2	205·9	206·9	281·4
ALL CAUSES	1,146·6	1,425·5	1,234·4	1,075·5	1,086·2	1,149·8	1,340·0	1,144·3	742·0	953·6	873·4	1,151·7	1,078·4
IV.—DEATH-RATE OF THE YEAR—													
Cholera	—	—	·55	·37	—	—	—	—	—	—	—	—	·05
Small-pox	—	—	—	·18	·09	—	—	—	—	·57	—	—	·07
Enteric fever	—	1·23	1·66	3·85	5·67	3·05	5·32	4·54	5·02	2·29	5·17	5·57	4·29
Intermittent fever	—	4·90	2·21	—	·62	·23	·69	·23	·63	·29	·12	—	·50
Remittent fever	·96	—	—	—	·27	·47	—	—	1·26	—	·24	·31	·20
Simple continued fever ..	—	—	—	—	—	—	—	—	—	—	—	—	—
Heatstroke	·96	—	1·66	·37	·98	1·64	1·85	·81	·63	—	·12	·31	·76
Circulatory diseases ..	—	—	—	1·10	·53	2·11	·69	1·63	2·51	1·14	·84	·62	1·01
Tubercle of the lungs ..	—	—	1·11	1·10	·62	·47	·92	·35	1·88	—	·12	1·24	·59
Pneumonia	—	—	—	·73	1·60	·94	·93	·23	2·51	·29	1·20	1·86	·97
Other respiratory diseases	—	·61	—	·18	·18	·23	·69	·23	·63	—	·36	—	·25
Dysentery	1·92	—	3·32	·92	·89	—	·93	·35	·63	—	·96	·62	·69
Diarrhœa	—	—	—	·18	—	—	—	—	—	—	·12	—	·05
Hepatic abscess	2·87	·61	11·06	1·83	·98	·94	2·31	1·63	1·88	1·43	1·32	5·26	1·85
ALL CAUSES	12·45	11·65	24·32	14·30	15·87	14·08	17·59	13·73	21·34	6·87	13·33	18·27	14·68

the lungs of 12 cases of broncho-pneumonia occurring in children and adults these observers isolated and identified the influenza bacillus in four; and in four of the other cases a bacillus was found morphologically identical with the influenza bacillus and resembling it also in such cultivations as were obtained. Jochmann and Moltrecht also have isolated a bacillus indistinguishable from the bacillus of influenza in 20 out of 22 fatal cases of broncho-pneumonia occurring as a complication of whooping cough in children. This bacillus was identical with that previously isolated by Jochmann and Krause from the sputum of children suffering from uncomplicated whooping cough, and called by them the *Bacillus pertussis*, Eppendorf.

Cholera.—Only three cases of cholera were admitted among the European troops during 1902, as compared with 12 cases admitted in 1901, and 107 cases in 1900. In 1901 and 1902 all the cases were fatal. The man who died from cholera at Fort William was supposed by the medical officer to have contracted the disease by swallowing water while bathing in the Fort swimming bath. In the two cases occurring at Dinapore the origin of the disease could not be traced.

Small-pox.—Both the admission rate and the death-rate on account of small-pox rose very slightly during 1902 as compared with 1901 ; the number of admissions and deaths respectively being 23 and 4 in 1902, as compared with 20 and 3 in 1901. At Meerut there were three admissions with one death ; at Quetta three admissions ; at Lucknow, Meean Meer, Kirkee and Bellary, two admissions each, with two deaths at Bellary. At no other station was there more than one case. The cases at Meerut are stated to have been probably contracted in the bazaar. The man who died at this station had been twice vaccinated, the last time in 1898. At Quetta small-pox was very prevalent in the district from March to May. At Kirkee one man developed small-pox while in hospital for venereal disease.

Ague, remittent fever, simple continued fever, Malta fever.—Intermittent fever caused 23 per cent. of the total admissions during the year 1902 as compared with 27 per cent. during 1901. The admission rate per 1,000 was less than in 1901, but the death-rate was slightly increased. The most malarious of the four commands was, as in the previous year, the Punjab ; but the admission rate in this command was considerably lower than in 1901. In all the commands except Bengal there was a marked decrease in the admission rate as compared with the previous year. As in 1901, the highest admission rate on account of intermittent fever during 1902 was recorded among troops in the Burma Inland group ; but the troops in all the groups had decreased admission rates as compared with 1901, except those in groups IV, V, VII, and IX. The statistics of all the stations in the Burma group except Port Blair showed a marked decrease in the admission rate of intermittent fever as compared with the previous year, and in each of the four commands the statistics of more stations showed a decrease in the admission rate on account of this disease than an increase. Excluding hill stations a decrease in the admission rate of intermittent fever was noted in 1902 in 42 stations and an increase in 28 stations. The stations at which the highest admission rates were recorded were Fort Dufferin, Attock, Fort Lahore, Deesa and Saugor; all of which returned admission rates of over 850 per 1,000 of average annual strength. The admission rates recorded at Fort Dufferin and Fort Lahore were, however, lower than those of the previous year ; at the other three stations they were higher. Some of the stations at which the lowest admission rates on account of intermittent fever were recorded were Mallapuram, Madras, Bareilly, Thayetmyo, Trichinopoly and Calicut. Some stations with a large increase in the admission rate, as compared with 1901, on account of this disease were Attock, Saugor, Deesa, Cawnpore, Rawalpindi, Kurrachee, Nowshera, Peshawar, Agra, Mhow, and Fort William ; and some with a considerable decrease were Meean Meer, Nasirabad, Fort Lahore, Mallapuram, Fort Dufferin, Amritsar, Thayetmyo and Meiktila. In at least 20 of the hill stations a decrease in the admission rate on account of intermittent fever was also observed.

In nearly all stations where a decrease in the admission rate on account of ague occurred in 1902, as compared with 1901, the medical officers attribute the decrease partially or wholly to measures taken to prevent the breeding of *anopheles* mosquitoes by applying kerosene oil to pools and other collections of water. Judging, however, from an examination of the medical officers' reports of these operations against mosquitoes, it would appear that in only a very few stations were they carried out with sufficient thoroughness as to be likely to have affected the prevalence of mosquitoes in any considerable degree ; and it would be unwise to attribute the decrease in the prevalence of intermittent fever among British troops, a decrease which has been noted this year in the majority of stations throughout India and Burma, not only among British troops but also among native troops and prisoners, to such trifling measures as have been carried out. At Attock the principal source of the malaria-carrying mosquito was said to be the fire-tank at one corner of the barrack square, and a recommendation that this should be covered over was being acted upon. At Deesa the prevalence of malaria was ascribed to a heavy rainfall at the end of August which filled many mosquito pools, and the greater incidence of the disease among the men of the Royal Artillery was attributed to the nearness of their syce lines. Precautions against the breeding of *anopheles* mosquitoes

were taken, and prophylactic doses of 15 grains of quinine twice a week were reported to have been beneficial. At Saugor also the increase in malaria was attributed to unusual rainfall in November; the administration of prophylactic doses of quinine did not give good results. At Cawnpore a prophylactic dose of quinine was given daily and was said to have been beneficial, but the dose given is not stated. At Rawalpindi *anopheles* mosquitoes were found all over the barracks, although all drains were kept carefully swept out and kerosene oil freely applied to all pools and drains for some months, the cantonment authorities having given 100 rupees a month to be spent on kerosene oil for this purpose. Quinine was also used as a prophylactic in this station, but evidently not with sufficient care. At Kurrachee the increased admission rate was attributed to unusual rainfall in the latter part of the year, and the admissions in November far exceeded those of any other month. Quinine parades were instituted and the British Infantry battalion was moved to a health camp 10 miles away, a reduction in the prevalence of malaria being soon afterwards observed. At Nowshera, from the middle of May to the 31st of October, kerosene oil was freely applied to all places where stagnant water was likely to collect; but in this station, as in many others, it is not stated whether any larvæ of *anopheles* were ever found, or whether the application of oil had any effect in reducing the prevalence of mosquitoes. At Bellary, Shwebo, and some other stations, on the other hand, the medical officers state that no *anopheles* larvæ could be discovered by careful search, but that kerosene oil was nevertheless used as orders to that effect had been received. The medical officer at Agra was unable to account for the greatly increased prevalence of malaria among the troops, but the disease was said to be more prevalent and severe throughout the whole district than in any previous year. Mosquitoes abounded everywhere, and *anopheles* larvæ were found in small tanks in connection with wells, as late as the middle of November. The stagnant water in the moat was found to be a favourite breeding ground of mosquitoes. At Mhow, which is one of the few stations where a systematic search for *anopheles* mosquitoes appears to have been made, the larvæ were first found in March. In July and the following months numerous *anopheles* larvæ were found in the overflow water of wells, the water of road-side culverts, drains for carrying off lavatory water, a few tanks, tins containing water placed round the hayricks in case of fire, surface drains, ditches and shallow ponds. It was found impossible to deal effectively with the drains, and larvæ were found in them up to the end of the rainy season. Numerous larvæ were found in the *kutcha* drains near the regimental bazaar, and the medical officer says that nothing is easier than for the mosquitoes developed in these drains after biting infected people in the bazaar to find their way into the adjacent barracks." In support of this contention, it was found that men in the barracks near the bazaar suffered much more frequently from malaria than those in the barracks further removed from it. The decrease in the admission rate for malaria at Meean Meer was far greater than at any other cantonment in India. This cantonment had been examined by the Royal Society's Malaria Commissioners in 1901, and operations based on their recommendations were carried out vigorously during 1902. The chief measures undertaken were: (1) an attempt to lessen the number of *anopheles* mosquitoes by dealing with all breeding places by the systematic cleaning of irrigation channels, the filling in of all pools, and the use of kerosene oil; (2) an attempt to lessen the danger of the large sources of infection of *anopheles* mosquitoes found in the presence of native lines and bazaars, by their removal to a distance or by the systematic treatment of all children in such lines with quinine; (3) an attempt to reduce the number of relapses and possibly of new infections by the regular administration of a dose of 10 grains of quinine twice a week to all the European troops. A summary of the operations carried out at this station up to the end of 1903 will be found under General Remarks, page 105.

The admission rate on account of remittent fever was slightly higher than that in 1901. The months of maximum prevalence of the disease among all the European troops in India were August and September, those of intermittent fever being October and November. Like intermittent fever, however, the disease was more prevalent during the year in the Punjab than in any of the other commands. In this command the monthly admission rates were almost equal from April to October. The maximum month of prevalence for troops in the Madras Command was July, that of intermittent fever being September; for troops in the Bombay Command the maximum month was April, that of intermittent fever being October. The highest admission rates were recorded at Fort William, Fort Chingrikhal, and Cherat.

The admission rate on account of simple continued fever was much lower than that of the previous year. The decrease occurred in the statistics of all the commands, but

like that of ague was most marked in the statistics of the Madras Command. As in 1901, the highest admission rate was recorded among the troops in the Bombay Command; but of the groups the Burma Coast group (1) had considerably the highest ratio. The month of maximum prevalence of this disease was June. The most frequent causes assigned for the attacks were excessive heat, exposure to the sun while at work or at musketry practice, and chills. In some stations all cases were so returned of which the cause was obscure and in which the blood did not react to Widal's test. At Bareilly, from which station the largest number of admissions during the year were returned, the majority of cases were kept under observation for enteric fever, but no signs of the latter disease having developed, and no obvious cause for the rise of temperature being observed, they were returned as simple continued fever. At Mhow some of the cases strongly resembled enteric fever and would have been returned as such but for the fact that Widal's test was negative. It is possible that some of these may have been cases of "paratyphoid" fever.

There were eight admissions and one death from Malta fever during 1902 as compared with five admissions and no death during 1901. Three admissions with one death were recorded at Kasauli, two admissions at Kirkee, and one admission each at Meean Meer, Jullundur and Rawalpindi, respectively. No information is given in the reports of the medical transactions of Meean Meer and Rawalpindi as to how the diagnosis of Malta fever was arrived at. In all the other stations the diagnosis appears to have been established by means of the serum test. In the case at Meean Meer the disease manifested itself after an attack of heatstroke. The medical officer at Kasauli states that this was apparently the first occasion on which the disease made its appearance there, and its cause could not be ascertained. The three cases were all of a severe type and one proved fatal. This case was first admitted for enteric fever, and it is said that Malta fever supervened upon this disease. In the case of another death recorded at this station the disease was first returned as Malta fever, on the grounds that the serum reaction was positive for this disease and negative for enteric fever, but after a short time it became evident on other grounds that the disease was, after all, one of enteric fever, and the original diagnosis was changed accordingly. These facts appear to throw some doubt on the value of the serum reaction test for Malta fever. No serious attempt has apparently been made up to the present in India to isolate the *micrococcus melitensis* from any case of Malta fever reported, and the proof of its existence as a disease of this country rests solely on the results of reactions obtained between cultures of the micrococcus and the serum of patients suffering from "fever."

Enteric Fever:—Water, Milk and Butter.—Although other ways by which enteric fever may be contracted and spread have recently received increased attention at the hands of observers, the dissemination of the disease by means of water still holds a most important place. According to Tavel the proof that water is the source of infection in any given epidemic can be arrived at in one of the following ways: (1) through the proof that the water has been contaminated by the dejections of typhoid fever patients; (2) through the proof that in a place which is supplied from two or more different sources, cases of enteric fever only appear in the houses supplied from a particular source; (3) through the direct proof of the presence of the enteric bacillus in the water by its isolation from it. He gives a critical analysis of the reports of epidemics in which the proof that water was the source of the disease was supplied by one or other of these methods, as well as an account of an epidemic in which he was able to isolate the enteric bacillus from the water. Springfield also has compiled statistics showing that a number of epidemics of enteric fever occurring in the industrial districts under his charge were due to direct pollution of the water-supply, and Gärtner has collected statistics which tend to prove that many epidemics of enteric fever must be attributed to polluted spring water. As regards the proof by the isolation of the bacillus of Eberth from a suspected water-supply, all observers are agreed as to the extreme difficulty of finding and correctly identifying the bacillus in water, and it is a matter of some difficulty to separate trustworthy from worthless observations on this subject. Tavel states that during fifteen years of work he has only once succeeded in finding the typhoid bacillus in water, and Busquet is reported to have said that out of 984 bacteriological examinations of water which he had made with the object of searching for the bacillus only five gave positive results. Koch, who, after much experience, has come to the conclusion that the bacillus has only a very short life in water, states that in his recollection he has only once been able to prove the presence of the bacillus in a suspected water, and in that case only because the well from which the sample of water was obtained was being continually contaminated anew

by the stools of typhoid patients. Bonhoff has also given instances of the cases in which he considers the bacillus was correctly identified in the water-supply, and arrives at the conclusion that they are extremely few ; and that much time may be wasted in a hopeless search for the typhoid bacillus in water. Finally Reichenbach in an account of the relation of well water to enteric fever, expresses the opinion that if there is distinct evidence on other grounds that cases of enteric fever have been due to the water of a particular well, it is only a waste of time to look for bacilli in the water ; it is a question not of whether there are or are not enteric bacilli in the water, but of whether the surroundings and condition of the well are such that the bacilli could have got into it or not. As was noted in this report for 1901, and as has since been pointed out by Tavel, Neufeld, Bonhoff, and others, the frequent negative results of examinations of water are due in many cases to the fact that, owing to the comparatively long incubation period of the disease and to the fact that the diagnosis of the first case in an epidemic is often uncertain, by the time a bacteriological examination comes to be made all the typhoid bacilli have long since disappeared from the water. Bonhoff gives it as his opinion that on an average the bacilli are not present in water longer than four weeks after the moment of infection, that is about 14 days after the outbreak of the disease, and Neufeld states that the bacilli cannot remain alive in unsterilized water longer than two to three weeks. On the other hand Tavel has shown that under certain circumstances typhoid bacilli can remain alive and virulent in water for several months, as, for example, when they are present in the comparatively stagnant water at the blind end of a pipe. He considers, however, that such a length of life of the bacillus in water is exceptional, and that it is much more frequently the case in epidemics that the water is constantly being freshly contaminated during rain-storms or by other means. But it appears that the typhoid bacillus can remain alive much longer in the mud and sediment at the bottom of a well or pipe than in the water itself ; and Busquet, and later Bonhoff, have drawn attention to the necessity of examining the sediment as well as the water itself. In all the five positive findings of Busquet mentioned above, the water contained more or less muddy deposit. Some French authors have attempted to explain the frequent negative results of bacteriological examinations of water by saying that the bacillus after long sojourn in water changes its properties—the changes especially referring to its capacity for being agglutinated. Rodet and Lagriffoul for example have pointed out that different races of the same bacillus may behave differently as regards their agglutination properties, and enteric bacilli from the organs or from water may even be altogether refractive to agglutination. They consider that it must now be admitted that the agglutinability of a bacillus is not the infallible specific criterion it was believed to be, but a contingent and variable quality like other properties of microbes. The difficulties of the research of the bacillus of Eberth in water have also been multiplied greatly since the discovery of numerous varieties of bacilli closely resembling the typhoid and colon bacilli, and according to Burnet (who states that Pellegrini has counted no less than 75 varieties of " false-typhoid bacilli " in the water of Pisa), Bienstock, Simpson, and others, no certain method for its isolation from water has yet been discovered. Neufeld in referring to the isolation of the bacillus from fæces says that none of the methods are suitable for the practitioner but that all are suitable for the expert, and that experience and practice are of more importance than the exact method used ; and a similar observation may be made with regard to the isolation of the bacillus from water. Some of the newer methods are those of Chantemesse, Schepilewsky, Altschüler, Hergemann, Schüder and Cambier. The chief difficulty of the research consists in the separation of true typhoid bacilli from the *B. coli communis* and others closely resembling it. Fitz Gerald and Dreyer consider that the neutral-red method as usually employed for the differentiation of *B. typhosus* and *B. coli* is uncertain, because certain species of Eberth's bacillus and of the *B. coli* do not produce any change of colour in the medium, and different samples of neutral-red are reduced unequally. Roth has devised a method of differentiating these bacilli, consisting in the addition of a 1 per cent. solution of caffeine to the medium, which prohibits the growth of coli but not of typhoid bacilli ; and Omelianski a method based upon the principle that certain microbes when cultivated upon gelatine to which phenolphthaleine and formate of soda have been added, decompose the latter and set at liberty carbonate of soda, in the presence of which the phenolphthaleine causes the medium to become of a rose colour. On this medium the coli bacillus grows well, while the typhoid bacillus only grows very slowly, so that after 24 hours the typhoid colonies, not having developed very much, do not cause any change in the colour of the medium, while the coli colonies have changed it to a rose colour. Koch considers that of all the methods for the separation of the typhoid bacillus from others resembling it that of Drigalski and Conradi is the best. Neufeld insists on the fact that in order to be

certain that a bacillus isolated from water is really a true typhoid bacillus it must not only agree in all its morphological, cultural, and chemical characters with a known true typhoid bacillus (controls experiments with which must be made at the same time), but that Pfeiffer's immunity experiments must also be carried out, and the bacillus must be agglutinated by the serum of an immunized animal in high dilution, as is the case with a known true typhoid bacillus. According to him the agglutination test can be free from objection only when a powerful serum, the agglutinating power of which is exactly known, is employed. An agglutination with a low dilution of the serum such as 1 in 100 or under, can never be regarded as conclusive; and still less value is to be attached to agglutination when, as is frequently the case, the experiment is made with the blood of a typhoid fever patient, or of a convalesent from the disease, instead of with the serum of an immunized animal; because the blood of typhoid fever patients and convalescents frequently possesses a considerable power of agglutinating certain kinds of *B. coli*. For this reason the methods of isolating the typhoid bacillus from water described by Simpson and others cannot be regarded as satisfactory. Although true typhoid bacilli are so rarely found in water, it is common in India, as elsewhere, to find bacilli of the *coli* group; and it is an important matter to decide whether such a finding, and especially the finding of *B. coli communis*, should be regarded as indicating fæcal contamination of the water. It is usual to say so, and according to Neufeld if such bacilli are abundant in the water so that they can be found on ordinary planted-out plates, one can with some certainty decide that the water has been contaminated. In other cases, however, where the *B. coli* is contained in only a few isolated specimens of the water, and can be cultivated from it only by special methods, Neufeld considers that most observers would not think it justifiable to draw such a conclusion, since the *B. coli communis* has often been found in water which is quite free from suspicion. Having regard to this fact some workers have advocated that the *pathogenicity* of isolated *B. coli* should be regarded as the best criterion of the purity or otherwise of a drinking water; and they consider that if *B. coli* isolated from water are non-virulent when injected into small animals the water may be considered as free from dangerous pollution. This question has been studied by Savage, who concludes that the pathogenicity of isolated *B. coli* is of no help in determining the harmfulness of the water examined, and that virulence as a property of *B. coli* is a very variable character and one which can be readily lost and with greater difficulty acquired. According to Klein the fact that a microbe, owing to insufficient response to certain tests, can be described only as a "coli-like" microbe is at present of indeterminate value in making a definite diagnosis of sewage or other pollution, and it is only when typical *B. coli communis* are found that a certain diagnosis of excremental pollution can be made. Winslow and Miss Hannewell have made a study of the distribution of the *B. coli* and of Houston's streptococci in polluted and unpolluted waters. Their general conclusions were: (1) micro-organisms which ferment sugar are in general rare in non-polluted waters; (2) the *B. coli* is very rare in non-polluted waters (5 times in 157 specimens of water); (3) the group of streptococci and staphylococci would appear to be intimately associated with a recent pollution by sewage. They were found 3 times in 157 specimens (1 c.c. each) of unpolluted water and 25 times in 50 specimens of polluted water. Jordan has also found that in freshly polluted river water non-chromogenic staphylococci were much more abundant than in the purer waters, and that fluorescent bacteria and a group of non-gas producing non-liquefying bacteria were less abundant in polluted than in purer water. As regards the purification of water Proskauer and Schüder have published a favourable account of the use of ozone in actual practice on a large scale at Wiesbaden; and Vaillard has made a special study of the means of purification of water applicable to troops on the march. He comes to the conclusion that the most practicable and efficient method is by the addition of chemicals to the water, and recommends especially the iodine method.

According to Neufeld, milk is, next to water, by far the most important agent in connection with the epidemiology of typhoid fever, and Schüder gives statistics of 110 epidemics as being caused through milk as compared with 462 through water. Since milk is a good medium for the growth of the typhoid bacillus it is often possible to recognise the cause of the disease much sooner in this than in any other medium. Bruck has made a very complete experimental research on the communication of typhoid fever by means of butter. Most of the previous researches on this subject had not been made under such conditions as would usually be met with in actual practice. Three series of experiments were made by Bruck. In the first, pure typhoid cultures were added to milk, and butter was made from the cream which formed after allowing the milk to stand. Typhoid bacilli were found in the cream and in the butter. In the second series the

vessel containing the milk and the apparatus used for making the butter were rinsed with water to which typhoid bacilli had been added. In the third series some pieces of cloth were contaminated with typhoid dejections and then washed in water which was afterwards used to wash out the vessels and apparatus. In all these series of experiments typhoid bacilli were found in the cream and in the butter, even when only a very small quantity of typhoid material was used for contamination. Bruck also found that after the typhoid bacilli had reached the butter they were capable of remaining alive in it for 27 days.

Enteric fever:—*Soil. Dust, Flies, Clothes.*—That an intimate connection exists between sewage polluted soil, and outbreaks of enteric fever is well known, but, as Neufeld points out, it is not the actual soil itself which is of significance in connection with typhoid infection, for the experiments of Koch and others have shown that typhoid bacilli find no conditions in soil which permit of their increase. On the contrary, as Poore has shown, the soil is effective in bringing about the destruction of pathogenic germs, and according to him enteric fever cannot in any way be considered as a "soil disease" in the proper sense of the term. Koch says that the typhoid bacillus is not capable of a saprophytic existence in the ground; and according to Neufeld the reports of earlier authors, such as that of Fülles, who said that the bacilli could be found in any sample of cultivated land in the neighbourhood of Freiburg, and those of Remlinger and Schneider are wrong, and are the result of confusion of the typhoid bacillus with other similar kinds. Such experiments as those of Rullmann, who found that typhoid bacilli were capable of remaining alive in *sterilized* earth longer than a year, are of little value in this connection because they were not made under natural conditions. It is a different matter however if typhoid bacilli reach the soil in conjunction with some suitable medium such as in the fæces, or inside a corpse, and although even under these circumstances but little increase of the bacilli takes place they can remain alive a long time, and under certain conditions can easily effect a spread of the disease to more distant places. Thus Lösener was able to cultivate the bacilli from a typhoid spleen which had been buried 96 days, and, having regard to the difficulties of isolating and identifying the bacillus, Neufeld considers that under such circumstances typhoid bacilli could remain alive much longer even than this. Koch considers that in damp ground, if the bacilli reach it in conjunction with fæces or other suitable medium, they may perhaps remain alive a fortnight, or even occasionally as long as several months. He says, further, that it is possible they can remain alive throughout one winter on the fields, if they are placed there along with the contents of latrines for example, but not much longer; and sums up his conclusion by saying that though the typhoid bacillus may perhaps be able to remain alive outside the human body (especially in the soil) somewhat longer than the cholera bacillus, still, even in that medium, it dies out in a comparatively short space of time. Neufeld admits that a spread of infection can result occasionally from a contaminated soil by infected particles of fæces being blown in the form of dust and deposited on food, &c., and Pfuhl has observed cases where the infection was produced in this way, and where it was proved that the surface layers of the ground had been contaminated by typhoid excreta. Under the conditions of war, where much pollution of camping grounds usually occurs, this mode of infection has lately come to be regarded as a very important one by many observers. Ormerod considers this to be the way by which infection is usually spread in the west of Queensland, where whirlwinds are frequent, and Firth and Horrocks state that infected dry soil, if blown about as dust, is capable of infecting distant objects after 24 days from the time of dessication. That the typhoid bacillus does not, like the tubercle bacillus, as a rule remain alive in the fine dust of a room in which it may be spread about by gusts of wind or draughts, is shown, according to Neufeld, by the epidemiological facts of the disease as well as by many laboratory experiments. Still, the possibility of a few isolated cases being due to this method must be admitted, and according to Schmidt and Weis the enteric bacillus can survive in the air even after thorough desiccation for several weeks.

The question of the conveyance of typhoid infection by means of flies has been closely studied by Ficker, who has shown that 23 days after they have been fed on typhoid cultures flies can still contaminate the objects on which they rest. The bacilli were found on the head, feet, wings, and in the intestines of the flies. Hamilton, in a study of an epidemic of typhoid fever in Chicago, made an exhaustive enquiry into the part played by the common house fly in the dissemination of the disease. Flies caught in two undrained privies, on the fences of two yards, on the walls of two houses, and in the room of a typhoid patient, were used to inoculate 18 tubes, and from five of these

tubes the typhoid bacillus was isolated. The conclusion arrived at was that when discharges from typhoid patients are left exposed in privies or yards, flies may be an important agent in the dissemination of the typhoid infection. Nash, in a paper on the seasonal incidence of typhoid fever and summer diarrhœa, gives facts in support of the agency of flies in the spread of enteric fever, and states that milk infected by flies is the chief factor at least in the case of summer diarrhœa. Dudfield has also obtained evidence of the spread of enteric infection by means of flies, and Welch and others have drawn attention to the importance of this agency. On the other hand, Turner considered the agency of flies in the spread of enteric fever in the South African war to have been unimportant, and states that the highest proportion of admissions for this disease occurred in midwinter when flies were not troublesome.

The danger of contracting infection from soiled clothing has been brought vividly into prominence by the outbreak of typhoid fever which occurred on the training ship "Cornwall," in the case of which the source of infection was traced to contaminated blankets returned from South Africa. Klein is said to have reported that these blankets contained innumerable typhoid bacilli, and if such was the case, the occurrence throws additional light on the persistence of vitality of the enteric bacillus on fabrics, and on the danger of infection by other means than through water. The researches of Firth and Horrocks on this subject were referred to in this report for 1901. Garvin also has described an epidemic of typhoid fever occurring among the Boer prisoners of war at Ceylon, in which the infective material was shown to have been conveyed from South Africa on the clothes of the prisoners themselves.

Enteric fever.—Direct infection.—That enteric fever is frequently communicated by direct infection from one case to another is now recognised on all sides. Neufeld says it is proved by the fact that where a typhoid patient is treated in his own home under bad hygienic surroundings it often happens that a series of cases, separated from one another by intervals of several weeks, occur among the members of his family: thus showing that it is not a question of a common source of infection but of a communication from case to case. Cases of enteric fever occurring among sick attendants or nurses in hospitals, instances of which were given in this report for 1901, frequently offer good examples of this mode of infection. Koch considers it to be, perhaps, the most important of all methods by which typhoid fever is disseminated. In his successful campaign against the disease at Treves he found that all the cases were to be referred to contact; the infection was always carried directly from one person to another, and no trace of a connection with water was to be found. The cases occurring in a house always formed a series in which the disease first attacked one person, then two or three weeks later another, several weeks later another, and so on. An important discovery was the fact that the disease was spread chiefly by the school children, who were always together for the whole day and who frequently carried infective material on their boots from the latrines into the houses. Musehold has described a military epidemic occurring in the autumn of 1900 in Strasbourg, in which the mode of infection was from person to person, and in the sanitary report of the Prussian States for 1895–1897 a number of examples of this mode of infection are given. In an outbreak of typhoid fever occurring in a town in New South Wales, investigated by Millard, it was shown that, although the original source of infection was traced to contaminated milk, yet after infection from this source had ceased, the disease continued to spread to other inmates of houses in which cases had occurred. Hill is reported to have traced one-seventh of all the cases of typhoid fever occurring in one year in the city of Birmingham to personal infection, and Niven is said to have obtained a very similar result with regard to the cases occurring in Manchester. Horton-Smith has published an account of a small epidemic limited entirely to one family, consisting of the father, mother, three daughters, and two sons. All were attacked and two of the daughters died. The first case was undiagnosed, and no attempt was therefore made at isolation, and no precautions taken to prevent the spread of the disease. The second case was attacked about three weeks after the first, and the third, fourth, and fifth a short time after. The sixth and seventh cases occurred about a fortnight after the fifth. In all the cases the attacks were clearly proved to be due to direct infection from the first case or from other members of the family. Bulstrode, Welch, Garvin, and others have also drawn attention to the dangers of this mode of infection. According to Neufeld cases of direct infection are often the result of infective material being taken up on the fingers of attendants either from the soiled body of the patients, or from the bed, or from the utensils used by him, and thence being conveyed to the mouth either directly or through the medium of articles of food. It is not necessary, therefore, for a person to live in the

same room with a patient to become infected in this way from him. Utensils used by a patient, unless thoroughly disinfected, can also be the means of spreading infection in this way for a long time after they have ceased to be used by the patient, since the researches of Gaffky, Pfuhl, Uffelmann, and others as quoted by Neufeld, have shown that the bacilli can remain alive in the dry condition for several months.

Enteric fever.—The bacillus.—In order to obtain successful results in the search for typhoid bacilli in the blood it is necessary, according to Neufeld, to dilute the sample of blood used in the examination very largely, in order to do away with its bactericidal properties. This principle was first successfully carried out by Castellani and Schottmüller. The former obtained 12 positive results out of 14 cases, and the latter 40 out of 50, and in a second series 58 out of 69. Auerbach and Unger got a positive result in 7 cases out 10, Hewlett in 20 out of 24, and Cole in 11 out of 15. Courmont, who only examined typical and severe cases of the disease, found the bacillus in all the 9 cases he examined, and in 4 of the cases even before the Widal reaction was present. Troussaint has also published a case in which the blood contained the bacillus on the fifth day when the serum reaction was still negative. Courmont and Lesieur in an account of all the cases examined by them, either separately or when working in conjunction, claim to have discovered the bacillus in all of 33 cases in which the blood was examined within the first 20 days of the disease. In 4 cases examined on the 20th day, or later, the result was negative. They draw the following conclusions from their work: (1) in all typical forms of the disease the presence of the bacillus in the blood is constant up to the end of the third week; (2) a positive report can usually be given in 24 or 48 hours, but one must wait up to the fifth day after making the culture before a negative result has any signification; (3) there is no evident relation between the agglutinating power of the blood and the rapidity of growth of the culture; (4) the examination of the blood for the bacillus is a method of special value in cases where Widal's reaction is not positive until late on in the disease. Their results have been confirmed in all essential points by Widal, who, however, was unable to obtain a positive result in five mild cases which he examined. These researches show that classical typhoid fever is essentially a septicæmic disease.

Neufeld says that nearly all recent authors agree that typhoid bacilli appear in the urine in $\frac{1}{4}$ to $\frac{1}{3}$ of all cases. Fuchs found the bacilli in 14 out of 41 cases, Richardson in 21 per cent. of cases examined by him, and Vincent in $\frac{1}{5}$ of his cases. According to Neufeld the bacilli appear in the urine at earliest towards the end of the second week, but in most cases later than this, and most frequently first during convalescence. In Vincent's cases the bacilli appeared first in the urine between the 11th and the 17th days of the disease, and their presence did not appear to bear any relation to the gravity of the case or to the abundance of albuminuria. He confimed the fact of the persistence of bacilli in the urine after recovery, and observed three cases of persistent bacilluria. In one of these cases the disappearance of the bacilli was brought about by washing out the bladder with permanganate of potassium solution, and this fact as well as the fact that none of the cases presented any signs of renal disease, led him to think that the bacilli simply increase in the bladder and do not come through the kidneys. Jacobi gives an account of the literature of the subject and a criticism of previous work. From his own results he concludes that bacilluria appears generally from the 13th to the 16th day of the disease, sometimes earlier, and sometimes only during convalescence. It is most frequently observed when the kidneys are diseased and in conjunction with albuminuria, but he admits that it may occur in the absence of any appreciable renal lesion. According to Neufeld and most other authors the administration of urotropine quickly results in the disappearance of bacilli from the urine. Fuchs, however, in the researches referred to above, found that it only caused a temporary reduction in the number of bacilli, that is, that it had only an inhibitory action, and did not cure the case entirely. Ledingham, in the report of a case of typhoid fever in which renal symptoms predominated throughout (the so-called "nephro-typhoid" class of case of Continental authors), states that the prolonged administration of urotropine seemed in no way to affect the number of micro-organisms present in the urine, and typhoid bacilli were found fairly abundantly in a specimen of urine passed by the patient on the day of his discharge from hospital. Goldschmidt has written about a new urine disinfectant, helmitol, which is a preparation similar to urotropine, but having the advantage over that drug of being more soluble in water.

In his experiments in combating typhoid fever Koch has employed the method of Drigalski and Conradi in preference to all others for isolating the typhoid bacillus from

the fæces. He states that with this method a sure diagnosis can be given in 20–24 hours, and at a much earlier stage of the disease than that at which it is possible to obtain Widal's reaction. In one case which occurred in his laboratory the diagnosis was proved on the second day of the disease. In addition it was possible by this method to isolate typhoid bacilli from the stools of many people who were apparently healthy, but who had come into direct contact with cases of typhoid fever. Chantemesse has shown that in some cases of typhoid fever the bacillus may still be present in the stools for over a month after the cases have been cured, and in this way may be explained the diffusion of infection and the apparently spontaneous occurrence of many cases of typhoid fever.

Jehle isolated typhoid bacilli not only from the hæmorrhagic sputum of cases complicated by pneumonia, but even in cases complicated with simple bronchitis. Similar observations by other workers were quoted in this report for 1901. From a careful survey of the literature corroborated by his own bacteriological investigations Glaser concludes that the part played by the typhoid bacillus in cases of lobar pneumonia occurring in typhoid patients is only of secondary importance, the infecting organism being unquestionably the pneumococcus. Glaser, Jehle, and others have found that the typhoid bacillus may still be present in the sputum some time after convalescence is well established. Glaser points out that if the sputum be not disinfected for a considerable period it may prove a source of infection, and Jehle considers it possible, though not probable, that infection may be contracted by cough-spray. According to Welch there is at present no positive or experimental proof that the origin of the disease can occur through the respiratory tract, and the finding of typhoid bacilli in the sputum is so rare as not to deserve consideration from this point of view.

Some of the opinions of observers on the vitality of the typhoid bacillus in water, soil, air, and other media have been mentioned above. The experiments of Levy and Kayser are of interest as showing that the typhoid bacillus can, under certain circumstances, retain its vitality in fæces for a long time, and as throwing some light on the more important question of the length of life of the bacillus when it reaches the soil in conjunction with that medium. These observers caused the stools of a typhoid fever patient to be deposited without previous disinfection in a cemented cesspit, in which they were allowed to remain during five winter months. At the end of this time the stools were spread as manure on a garden with a clay soil, where they remained 15 days at the winter temperature. By the examination of the manure at the end of this time it was still possible to isolate typhoid bacilli from it. As no stools from healthy persons were placed in the cesspit with the typhoid stools, the experiment cannot be said to have been made under such conditions as would occur in actual practice, and MacConkey has shown that the presence of the typhoid bacillus cannot be demonstrated in crude sewage or sewage effluents after the lapse of 6–17 days. Pfuhl's results with regard to the length of life of the typhoid bacillus in some of the various media experimented with by him were as follow :—In damp garden earth, 88 days ; in dry sand, 28 days; in water, 26 days ; in milk, 11–13 days ; in butter, 24 days ; in Gervais cheese, 24 days ; on dried linen, 97 days. Kurpjuweit has shown that typhoid bacilli placed in sterile olive oil can still retain their vitality after 10 days but not after 14 days. The interesting experiments of Macfadyen communicated to the Royal Society through Professor Dewar showed that the typhoid bacillus when immersed in liquid air (about — 190° C.) for at long as six months showed no impairment of vitality ; the fresh growths obtained were normal in every respect and the functional activities of the organisms were unaffected.

Enteric fever—Paratyphoid fever.—At the present time the opinion appears to be gaining ground that the clinical term enteric fever includes a group of diseases caused by quite distinct, though very similar bacilli, and that the diseases of this group can only be distinguished from each other by bacteriological research. Attention seems to have been drawn to the subject chiefly by the discovery that in certain typical cases of enteric fever the Widal reaction was persistently negative. In 1897 Gwyn studied such a case, but in 1896 Achard and Bensaude had already isolated a bacillus intermediate between the true typhoid bacillus and the *B. coli communis* from cases of fever clinically resembling enteric fever in every respect, to which they gave the name of "paratyphoid" bacillus. Since then similar bacilli have been isolated from cases by many observers in France, America and Germany, and paratyphoid fever has come to be recognised as a distinct and widespread disease. Reviews of the literature of the disease have been published by Pratt, Neufeld, Kayser, and others. C. Fraenkel in commenting on a case investigated by Hume which was diagnosed clinically as enteric fever, but in which a bacillus differing

from that of Eberth was isolated from the stools and from the cystitic urine, remarks that such cases explain those reported as "undoubted enteric with negative Widal." Still it is not justifiable to regard all cases clinically resembling enteric fever in which the Widal reaction is negative as paratyphoid fever, for this reaction sometimes fails in true enteric fever. Hoffmann, for example, divides the cases clinically resembling enteric fever collected by him into three groups. In the first group of 2,464 cases clinically and epidemiologically resembling typhoid fever Widal's reaction failed 158 times; in the second group of 131 cases in which "Eberth-like" bacilli were found the reaction failed 12 times; in the third group of 18 cases in which Eberth's bacillus was found eight of the cases gave a negative reaction. Out of 69 cases of suspected typhoid fever Schottmüller separated five which were due to the paratyphoid bacillus. The bacillus resembles very closely those of the Gärtner group which are known to be the cause of meat poisoning, and Neufeld draws attention to the similarity between former epidemics of disease known to have been due to meat poisoning and cases of disease now attributed to the paratyphoid bacillus. Like the bacilli of the Gärtner group paratyphoid bacilli isolated from different cases do not, according to Neufeld, agree in all respects with one another, and in the researches of Hoffmann referred to above the serum of rabbits immunized by injections of Schottmüller's paratyphoid bacillus, while it agglutinated this bacillus in a dilution of 1-1,800 was without any action on Kayser's paratyphoid bacillus. Schottmüller and Feyfer and Kayser however describe two types of the bacillus, viz., paratyphoid A and paratyphoid B; and Kayser in commenting on the results of Conradi, Drigalski and Jürgens lays stress on the fact that in the diagnosis of cases of suspected typhoid fever the serum reaction test must be carried out not only with the true typhoid bacillus, but also with *both* forms of the paratyphoid bacillus. From the practical point of view a diagnosis of paratyphoid fever is of importance as, according to Kayser, the mortality of the disease is only between 1 and 2 per cent. An account of the pathological anatomy of a case of the disease has been published by Lucksch.

Enteric Fever:—Suppression and Prevention: Inoculation.—Probably the most important contribution to recent literature on typhoid fever is the account by Koch of a successful campaign against the disease in a locality where it had been endemic for some years. In dealing with typhoid fever, as in dealing with malaria and cholera, Koch considers that measures of attack are better than measures of defence, and that if we can attack the typhoid bacillus at its source in man in a way comparable to that in which we can attack the malarial parasite, special precautions with regard to intermediate channels of infection such as water or soil are unnecessary. Koch admits that he was formerly of opinion that the typhoid bacillus was capable of a saprophytic existence outside the human body, retaining its vitality for long periods of time in water and in the soil; but that from longer experience he is compelled to abandon this view, and to regard the typhoid bacillus as an obligatory parasite for man alone. As in a campaign against malaria, therefore, the two conditions necessary to be fulfilled in the fight against typhoid fever are, first to be in a position to discover all cases of the disease easily, and at as early a stage as possible; and secondly to be in a position to destroy the bacillus in these cases. If this is done the further spread of the disease is impossible, and as typhoid bacilli cannot grow or retain their vitality for an indefinite period in water or soil, any of the bacilli that have previously found their way into either of these media must die out within a comparatively short space of time. Just as in an attempt to estimate the prevalence of malaria in a place but little information can be gained from a survey of the number of cases under treatment in the hospitals, so in the locality of Koch's experiment it was found that the lists of certified cases given by the local doctors gave a quite inadequate notion of the true extent of typhoid fever; and just as in the case of malaria it is necessary to examine the blood of the general inhabitants of a district in order to find out the prevalence of the disease there, so in the case of typhoid fever it was found necessary to use bacteriological methods for the discovery of all cases of the disease. The Widal reaction was considered inadequate as it makes its appearance too late in the disease and often fails in mild cases, and after much research into the best bacteriological method for securing prompt diagnosis, Koch adopted the method of Drigalski and Conradi for isolating the typhoid bacillus from the fæces. In the locality where the experiment was made only eight cases of typhoid fever had been notified by the local doctors, but by this method no less than 72 people were proved to be actually suffering from typhoid infection. Of these 72 people, no less than 52 were children, among whom only three cases had been notified. This discovery, which finds its parallel in the now well-known discovery of Koch with regard to malarial infection, shows that in a place where typhoid

fever has been endemic for many years the older generation, owing to previous attacks of the disease, have acquired an immunity to the infection. Every case in which typhoid bacilli were found was immediately isolated, and rigorous disinfection carried out, with the result that after three months, so far as the group of villages in which the experiment was carried out was concerned, typhoid fever was exterminated. In another group of villages under exactly comparable conditions typhoid fever continued to prevail, so that it may be inferred that its disappearance from the locality of the experiment was entirely due to the methods carried out there. From the point of view of prevention rather than of suppression of typhoid fever Bienstock has given an account of the measures carried out in Paris to prevent the spread of the disease, and statistics of the good results obtained; and Reichenbach an account of the arrangements in Göttingen. Captain Cooper, R.A.M.C., has published statistics showing the good effects of sanitation —more especially directed towards preventing the spread of infection by flies—in controlling the extent and virulence of typhoid fever and dysentery at Harrismith in South Africa. Besredka has prepared a vaccine by heating a culture of the typhoid bacillus suspended in physiological salt solution for an hour at 60° C., mixing it with antityphoid serum by which the bacilli are agglutinated, and separating the agglutinated bacilli from the serum by repeated washings with salt solution. The bacilli thus washed are said to exhibit remarkable capacity for conferring immunity on injected animals. The immunity of animals injected with these typhoid bacilli is said to appear in 24 hours, and during the process of immunization the susceptibility of the animal is not increased but rather diminished. The vaccine produces no alarming symptoms and remains active and effective for a long period. Macfayden, by triturating typhoid bacilli at the temperature of liquid air, has obtained a toxic fluid ("typhoid cell-juice") which was found to confer bactericidal and antitoxic properties on the serum of animals injected with it. A Committee appointed by the Royal College of Physicians to report on the practical safety and prophylactic value of antityphoid inoculations arrived at the conclusion that not only is a lessened susceptibility to the disease brought about as a result of the inoculations, but that the case mortality is largely reduced. The Committee also considered that with due care the process of inoculation was devoid of direct danger, but that under special circumstances there may possibly be some temporary increase of susceptibility to infection immediately following inoculation.

Enteric fever.—Opinions of Medical Officers.—It has been noted for several years that the majority of medical officers make little or no attempt te explain the origin of outbreaks of enteric fever occurring in their stations, and the year 1902 is not exceptional in this respect. Nearly 30 medical officers state either that the cause of the occurrence of cases of enteric fever in their station is unknown, or that "the origin could not be traced." Among the more interesting points noted in the medical transactions are the fact that a certain number of cases were contracted on troopships which had been constantly conveying troops, many of whom had recently suffered from enteric fever, to and from South Africa; and the fact that the disease was introduced into some stations by Boer prisoners of war who were brought to India while suffering from the disease. At Colaba the medical officer was certain that three cases were contracted on the troopships "Tagus," "Sicilia," and "Montrose," respectively, and he attributes a small outbreak which subsequently occurred to the introduction of the disease by the first of the above cases. At Madras the medical officer states that the disease was imported into the fort by Boer prisoners of war in March, four cases being admitted into hospital from the transport direct, and a fifth a fortnight later. An increase in the number of cases occurring among troops in the fort followed the admission of these cases. At the Boer camp at Kakool the introduction of the disease from South Africa by the Boer prisoners of war is also given as the reason for the origin of the cases among the troops, and at Wellington most of the cases occurred among men quartered in Kaiti camp as a guard over the Boer prisoners, among whom the disease was very prevalent. As usual, many cases originated elsewhere than in the stations in which they were treated, and the medical officers at nearly all the hill stations state that some of the cases were contracted at halting places or camping grounds on the road up. At Barrackpore, Allahabad Fort, and Mooltan, the medical officers note that in one or more cases the disease must have originated during the journey by rail from other stations. At Lucknow one battery of artillery escaped entirely. Out of the 54 men attacked at this station 19 had been only one year in India and 7 only one month. At Poona the disease was much more prevalent among the 1st King's Shropshire Light Infantry, and 11 lbs. of rancid butter, part of a daily consignment received from Bombay, was found in the dairy of this regiment at the time

the disease was most prevalent. At Quetta half the cases occurred among the men of the Royal Garrison Artillery, especially among the companies in camp, and the medical officer states that the cause during 1902 did not seem to be in Quetta itself. At Bellary all the cases occurred among the men of the East Yorkshire Regiment, which had recently arrived from South Africa. At most stations the disease was not confined to the men in any particular barrack room, but at Colaba, Agra, and Chaubuttia, the occurrence of cases from the same barrack room, closely following one another, was noted. In many cases the probable source was thought to be impure food or drink partaken of in bazaars, and the medical officer at Umballa, in noting the simultaneous prevalence of venereal disease and enteric fever in particular units, suggests the possibility of the latter disease being contracted at the time and place of exposure to the former. At Pachmarhi and at Quetta it is noted that the disease was prevalent among the inhabitants of the bazaar, and at Poona the nearness of the bazaar (100 paces from one of the barracks) is mentioned as a contributory cause. At several stations flies are said to have probably conveyed the infective agent from latrines to food, and the nearness of latrines to kitchens and the carelessness of natives in leaving the gauze doors of kitchens constantly open, are mentioned as contributing to the chance of this. At Jutogh a latrine was situated within 20 feet of the kitchen, and after its removal no more cases occurred. Duststorms are said have been the possible carriers of infective material from the filth trenches at Nasirabad and Rawalpindi. The practice of storing water after it has been boiled in wide-mouthed earthenware chatties where it is liable to contamination from dust, from the men's hands, or from animals is mentioned by several medical officers as a probable cause of many cases; and at Kirkee, where this practice obtains, B. coli was isolated from the previously boiled water. At several stations it is stated that cases were produced by drinking infected water from irrigation canals while the men were on manœuvres or in camp. The water supplies of Madras, Mhow, Kamptee, Wellington, Mandalay, Ahmednagar, Meiktila, and Umballa are specially mentioned, among others, as liable to contamination. In most stations, however, the water is boiled and treated with permanganate of potassium. Great care is apparently taken in the preparation of aërated waters and Pasteur filters are in use at many stations. At Ahmednagar, however, it is reported that the water is first boiled and permanganated, and afterwards passed through the Pasteur-Chamberland filter—a proceeding which might with advantage be reversed. Two cases at Agra were attributed to men drinking lemonade purchased in the bazaar. Milk purchased from hawkers or in bazaars was suspected as the source of cases in several stations, and although increasing attention seems to have been directed to the subject of dairy management, in a good many stations much remains to be done. The dairy building at Poona was reported to be in every way unsuitable, and the cattle lines were very foul from prolonged use. At Ahmednagar it is stated that although all the milk is boiled, the contractor, in order to save trouble, is allowed to take it to his own house in the bazaar to boil. At Lucknow there was a difficulty in getting milk from the Government dairy farm owing to many of the cows having been sent away temporarily, and in consequence milk was often purchased from bazaar hawkers. The great decrease in the prevalence of enteric fever at Agra is attributed to the improvement in the municipal waterworks, to the stream of the Jumna having been regulated and made to flow at a distance from villages which formerly were a source of pollution, and to the establishment of a Government dairy farm in 1899. At Bareilly the dhobi's washing ghat was moved to a site higher up the river, the water was boiled, and one of the regiments was moved into camp; but the medical officer is unable to say which of these measures, if any, caused the cessation of the epidemic. The decrease at Secunderabad was attributed to the small number of young soldiers, but the Middlesex Regiment, which had most young soldiers, suffered least, perhaps because they employ no native cooks and because milk is not allowed to be hawked about for sale in the lines. The fact that no cases were returned as enteric fever unless they gave the Widal reaction is assigned as a reason for the decrease in the number of cases at Mhow and some other stations. At Mhow, although for this reason the number of admissions was about half that of the previous year, the death-rate was nearly double, and the medical officer considers that in 1901 a number of cases were wrongly diagnosed as enteric fever, the small percentage of deaths and the monthly distribution pointing to this. At least 22 stations were without any case of enteric fever, and Lebong has been immune from enteric fever, locally contracted, for four years in succession. Nowgong has also been free, except for imported cases, for two years. In at least five stations patients developed enteric fever while in hospital under treatment for syphilis. In a fatal case of enteric fever at Jhansi tubercular cavities were found in both

lungs post mortem. A case returned as simple continued fever at Mhow convalesced after eight days' fever, but after twelve days' normal temperature he had a recurrence of fever and died four days later. At the post mortem examination typical ulceration and enlargement of Peyer's patches was found. At Quetta a man who was admitted for tapeworms suddenly became collapsed after passing a large number of the worms, and died four days after admission. At the post mortem examination typical enteric lesions were found in the small intestine.

Enteric fever in 1902.—There was an increase in the admission rate on account of enteric fever during 1902 as compared both with 1901 and 1900. With the exception of these two years, however, the admission rate is the lowest recorded since 1888. The death-rate in 1902 was also higher than in 1901, but slightly lower than in 1900. There were 1,012 admissions and 260 deaths from this disease during 1902, as compared with 776 admissions and 202 deaths in 1901. The average duration of a case during 1902 was about 55 days, and the average number constantly sick 151·41, so that the total annual loss of service due to sickness from enteric fever alone amounted to about 55,264 days.

Enteric fever in the geographical groups.—The highest admission rates during 1902 were recorded among the troops in groups VI, XII*a*, V, XII*b*, IX, and VIII, and from these groups except group VIII higher admission rates were returned than from the same groups in 1901. The admission rates returned from all the groups except group XII*b* were, however, lower than their decennial means. Eight stations of group VI and seven of group XII*a* returned admission rates of over 20 per 1,000.

Enteric fever in stations.—Among the stations at which the average annual strength was over 100, those at which the highest admission rates during 1902 were recorded were Kakool, Kirkee, Nasirabad, and Umballa; and those at which the highest death-rates were recorded were Kakool, Attock, Nasirabad, Roorkee, and Jubbulpore. Twenty-nine stations returned admission rates of over 20 per 1,000, as compared with 15 under the same heading during 1901. Of these stations Shahjahanpur, Bareilly, Roorkee, Meerut, Umballa, Fort Lahore, Sialkot, and Attock were in group VI; and Ranikhet, Bhim Tal, Chaubuttia, Lower Topa, Kakool, Cherat, and Quetta were in group XII*a*.

Relation of enteric fever to age and length of residence in India.—In 1902, as in 1901, the greatest liability to suffer and die from enteric fever was between the ages of 20 and 25, and during the first year of Indian service. In 1901 the incidence of the disease had been less than in 1900 at all age periods except the last, and in all service periods except the first; but in 1902 it was greater at all age periods except the first and the fourth, and in all service periods except the third and the fifth. In 1902 the liability of men under one year's service to fall sick from enteric fever was at least twice as great as in any other period of service.

Plague and some other general diseases—Dengue.—Among the whole European army in India during 1902 there were recorded only four admissions on account of plague, with one death, as compared with two admissions and one death recorded during 1901. Three admissions with one death were returned at Umballa and one admission at Belgam. No officers, women, or children were attacked during 1902. A single case of cerebrospinal fever, which recovered, occurred at Indore. The widespread prevalence of this disease among natives is mentioned in subsequent sections of this report. There were 76 admissions on account of measles, the largest number being recorded at Rawalpindi. Relapsing fever caused one admission at Poona. Out of the 39 admissions returned as beri-beri, 35, with two deaths, were recorded in Burma. Rangoon returned nine admissions with one death. Thayetmyo six admissions, Mandalay nine admissions, and Shwebo eleven admissions with one death. Four of the men admitted for this disease at Rangoon were sergeants, three of them belonging to the same regiment. All the men admitted were said to be free drinkers. In all the cases at Thayetmyo except one the symptoms were those of peripheral neuritis. The medical officer at Shwebo says that none of the cases were contracted locally. All the men who suffered were beer drinkers. Eleven samples of beer were sent for examination but no arsenic was found in any. There were 298 cases of dengue as compared with no case during the previous year. All except three of these cases occurred in the Madras Command, Thayetmyo returning 123

cases, Rangoon 84, and Mandalay 36. The epidemic at Rangoon lasted from March to the end of July, and the disease was thought to have been imported from Hong Kong by the Chinese. At Thayetmyo the epidemic prevailed from May to September, and at Mandalay during July and August. The disease in all stations was highly contagious, but mild in character and caused no deaths. Captain Pridmore, Indian Medical Service, has published an account of the disease as it appeared in Burma, in which he states that the Burma epidemic probably had its origin in a similar epidemic at Hong Kong previously described by Stedman, and that the spread of the disease in Burma followed the important trade route. Graham has attempted to show that dengue is communicated from the sick to the healthy through the agency of mosquitoes (*C. fatigans*).

Tubercle of the lungs.—The admission rate on account of tubercle of the lungs was the same during 1902 as during 1901, but the death-rate was slightly higher. For the quinquennium the mortality of the European troops as well as of the native, from tubercle of the lungs was highest in the Bengal Command. During 1902, however, the highest mortality among European troops from this cause was recorded in the Bombay Command. The death-rates of European troops, of native troops, and of prisoners during the year 1902 were in the proportions of 10, 14, and 75.

Pneumonia and other respiratory diseases.—The admission and death-rates on account of pneumonia were higher than in 1901, both being also higher than the decennial ratios. The troops in the Upper Sub-Himalaya Group (VI) had the highest admission rate for this disease. The months of maximum prevalence were January and February, and the months of least prevalence June, July and August. Among stations the highest admission rate was recorded at Campbellpur and the highest death-rate at Landour.

With the exception of those in the Hill Convalescent Depôts, the troops in the Bengal-Orissa group had the highest admission rate on account of other respiratory diseases during 1902. The stations with the highest admission rates were Sitabaldi, Pallavaram, Poonamallee, Muttra, Dagshai and Barrackpore. In all the above stations the admission rate was over 60 per 1,000.

Dysentery and diarrhœa.—Both the admission rate and the death-rate on account of dysentery were lower than those of 1901. The disease was as usual, most prevalent among troops in the Bengal-Orissa group, and also as regards the commands it was more prevalent and fatal among troops in the Bengal Command. The month of maximum prevalence of the disease as regards all the European troops in India and as regards the troops in the Bengal and Bombay Commands was August, but for the troops in the Punjab Command the maximum month was May, and for those in the Madras Command, June. The highest admission and death-rates were recorded at Barrackpore, (236·2 and 11·66 per 1,000 respectively) ; the next highest admission rate being recorded at Poonamallee (98·6 per 1,000). The medical officer at Barrackpore states that he cannot explain how it is that the men suffer to such an extent from dysentery while officers and civilians are immune. He attributes the men's liability to the disease chiefly to their careless habits, such as omitting to put on warm clothing after sunset or after taking violent exercise, excessive drinking, &c. He regards the disease as contagious, and gives the following instance. While nursing a women whose husband had dysentery a soldier's wife contracted the disease ; after she returned to her own quarters her husband and two children were attacked.

The admission rate on account of diarrhœa was lower than in 1901, but the death-rate was slightly higher. The admission rates among troops in the different groups varied between 23·4 per 1,000 in the Hill Stations group and 3·1 in the Western Coast group. Among stations the highest ratios were recorded at Chaubuttia, Sitabaldi, Lebong and Dagshai.

Hepatic abscess.—Both the admission and the death-rate on account of abscess of the liver were higher than in the previous year, the highest admission and death-rates being returned from the Bengal Command and the Bengal-Orissa group. Among stations, Barrackpore and Naini Tal returned the highest admission and death-rates from this cause. At Barrackpore there were 18 admissions with 10 deaths during 1902, as compared with 11 admissions with 5 deaths during 1901. Of the 18 cases, nine were attributed to dysentery and seven out of the nine died. For the remaining nine cases, of which three died, no cause could be assigned. The medical officer states that most of the men who died from abscess of the liver were said to be heavy drinkers. The type of

dysentery prevailing at Barrackpore is said to be the "amœbic." Of the six cases at Naini Tal, five were associated with dysentery. At the post mortem examination of one of the fatal cases tubercular cavities were found in the apices of both lungs. Other stations with moderately high admission and death-rates from abscess of the liver were Dum Dum, Fategarh, Lebong, Darjeeling, Landour, Murree and Deolali. At Subathu a fatal case occurred in a man convalescent from enteric fever. At the post mortem examination multiple abscesses were found. At several stations cases were, as usual, returned and treated for some time as cases of remittent fever, tubercle of the lungs, or some other disease, and in a few instances the true disease was only discovered at the post mortem examination. According to Vaillard and Dopter it is essentially the amœbic form of dysentery which is associated with abscess of the liver, the bacillary form never giving rise to this disease. Captain L. Rogers, Indian Medical Service, has also published further researches tending to show that the large tropical abscess is almost invariably associated with the amœbic form of dysentery. He considers that this form of dysentery has naked eye and microscopical characters which enable it to be easily distinguished from the more common bacillary type of the disease. Ranzi has reported a case of liver abscess due to Friedländer's bacillus, and Arnott a case of liver abscess in a child aged $2\frac{1}{2}$ years.

Alcoholism.—There were 11 deaths from alcoholism during 1902, giving a ratio of ·18 per 1,000 of strength, both figures being the same as in the previous year. The yearly average number of deaths in the decennium 1891–1900 was seven ; so that the figures of the last two years have been above the average.

Venereal diseases.—Among all the European troops in India during 1902 the total admission rate on account of venereal diseases was 281·4 per 1,000, as compared with 276·0 per 1,000 for the previous year, and 298·1 per 1,000 for 1900. In other words, among every 1,000 men in India during 1902 there were five more admissions to hospital for venereal disease than among the same number of men in 1901. The steady yearly decrease in the admission rate for venereal diseases, which commenced with the year 1896, has therefore been interrupted by a slight increase in 1902. From the reports of medical officers it appears that this increase is to be attributed chiefly to the arrival of a number of regiments, or drafts of regiments, from field service in South Africa. Some of these regiments and drafts brought the disease with them, and in addition it is mentioned by some medical officers that the hope that men recently returned from field service would be well provided with money, attracted more women from surrounding villages into the stations. Other causes were believed to be : the large number of cases contracted in regiments while marching between stations en route to Delhi and to the hills ; the recent arrival of regiments at stations ; the absence of cantonment hospitals in some stations ; and the fact that in several stations diseased women refused to attend at the cantonment hospital for treatment.

Heatstroke.—The death-rate from heatstroke was higher than in the previous year, all the commands sharing in the increase. The highest increase occurred in the death-rate of troops in the Punjab Command. Nowgong, Attock, Meean Meer, and Lower Topa returned the highest admission ratios, and Meean Meer, Rawalpindi, Mooltan, and Kamptee the largest number of admissions. Lower Topa, Fort Lahore, and Kamptee recorded the highest death-rates, and Rawalpindi, Kamptee, and Agra the largest number of deaths.

Invaliding.—In the whole European army of India 2,255 men were invalided during 1902 (37·25 per 1,000 of strength) as compared with 2,393 (39·33 per 1,000) during the previous year. The proportion of invalids to strength was lowest in the Punjab and highest in Bombay. There was a reduction of invaliding ratios in all the commands except Bombay. The percentage of men invalided while under 25 years of age to the whole number invalided was 35 as compared with 42 in 1901, and of those under 30 years of age 83 as compared with 88. Of the total number of men invalided 17 per cent. (as compared with 14 per cent. in 1901) were of less than two years' service, and 48 per cent. (as compared with 60 per cent. in 1901) were of less than five years' service.

Officers.—The chief cause of admission among officers was ague ; and while the admission rates on account of enteric fever, pneumonia, dysentery, and ague rose, those on account of simple continued fever, hepatic affections, venereal diseases, influenza, remittent fever, and respiratory diseases other than pneumonia, fell. The chief cause of death was enteric

fever, and the rate was higher than in 1901. The death-rate from dysentery was also increased. The admission ratios on account of diarrhœa, fevers except ague, influenza, hepatic affections, dysentery, and small-pox were higher than among the men, as were also the death-rates from fevers, dysentery, and circulatory diseases. In the great majority of stations nothing is said by medical officers as to the causation of enteric fever cases occurring among officers, and in most of the remainder the medical officers state that the origin could not be traced. In the case of the officer who died at Jullundur the blood was twice tested for Widal's reaction with a negative result, though in all the cases occurring among the men a positive reaction had been obtained. One of the cases at Kasauli was first diagnosed by the serum test as Malta fever.

Women.—The health of the women was not so good as in 1901. The chief causes of admission into hospital were debility, ague, and the diseases peculiar to women. Debility caused 40 per cent. of the total admissions, and ague 18 per cent. The chief causes of death among women were child-birth and abortion which caused 24 per cent., and enteric fever and remittent fever which each caused 13 per cent. of the total deaths.

Children.—The health of the children also was not so good as in 1901. The chief causes of admission were ague, respiratory diseases, and measles. Among diseases with increased ratios were measles, eye diseases, ague, dysentery, simple continued fever, and tubercular diseases. Ague caused about 22 per cent. and respiratory diseases 11 per cent. of the total admissions. The chief cause of death was diarrhœa. The death-rates of all the diseases in the table showing causes of death, except teething, dysentery, cholera, and small-pox were increased as compared with 1901. Diarrhœa caused about 20 per cent. of the total deaths, and anæmia, debility, and immaturity at birth 16 per cent. Out of the 200 admissions for measles the highest number, viz. 61, was recorded at Rawalpindi. Wellington returned the highest number of admissions from chicken-pox, and Rangoon the highest number from dengue. Two out of the five children who died from tubercle were below 18 months of age, and three were between two and five years.

The liability to death was greatest under six months, the high death-rate for this period being, as usual, to a considerable degree due to cases of immaturity at birth.

Native Troops.

Sickness and mortality in 1902.—The health of the Native troops during 1902 was, on the whole, better than during 1901, though there was a slight increase in the total death-rate.

Year.	Average strength.*	Ratio per 1,000 of Strength.		
		Admissions into hospital.	Constantly sick.	Mortality, including absent deaths.
1896–1900	127,223	781	30	15·69
1901...	122,866	829	30	13·89
1902...	124,231	718	27	15·01
1891–1900	127,666	852	32	16·62

* The quinquennial and decennial ratios are, of course, worked on the total strength of the five-year and ten-year periods respectively.

The chief causes of admission were ague, dysentery, venereal diseases, and non-pneumonic respiratory diseases. The admission ratios on account of small-pox, enteric fever, simple continued fever, tubercle of the lungs, pneumonia, dysentery, and

hepatitis were higher than in the previous year, and those of influenza, cholera, ague, remittent fever, respiratory diseases other than pneumonia, diarrhœa, scurvy, and venereal disease lower. Ague accounted for 38 per cent. of the total number of admissions from all causes. The chief causes of death were pneumonia and remittent fever. Among the diseases with increased death-rates as compared with 1901 were pneumonia and circulatory diseases, but the death-rates from cholera, small-pox, enteric fever, ague, remittent fever, and tubercle of the lungs were reduced. Pneumonia accounted for over 33 per cent. of the total number of deaths, and intermittent and remittent fevers for over 18 per cent. The total number invalided for discharge during 1902 was 1,430, as compared with 1,566 during 1901, the chief causes of invaliding being, as usual, debility, ague, venereal disease, and rheumatism.

The health of the China Garrison was better than in the previous year, that of the Somaliland Expeditionary Force was fair, and that of the Indian Coronation Contingent to England was good.

The native troops, as usual, suffered less from enteric fever, simple continued fever, diarrhœa, hepatic affections, and venereal diseases, and more from each of the other causes of admission given than European troops. The native troops also suffered more from scurvy.

Commands.—As in 1901 and in 1900 the troops in the Bombay Command were the most unhealthy during 1902. Of the troops in the four commands, those in the Bombay Command had the highest death-rates from ague, bowel complaints, hepatitis, and debility; those in the Punjab Command from enteric fever, remittent fever, tubercle of the lungs, and respiratory diseases; those in the Madras Command from cholera, small-pox, simple continued fever, and circulatory diseases.

Ratios of Commands.

—	Ratio per 1,000 of the Average Strength.					
	Bengal Command.	Punjab Command.	Madras Command.	Bombay Command.	Hyderabad Contingent.	Army of India.*
I.—Average Annual Strength	26,652	43,486	18,017	24,371	6,204	124,231
II.—Constantly-Sick-rate of the Year... ...	24·7	27·0	27·8	30·5	17·6	26·6
III.—Admission-rate of the Year :						
Influenza	·7	4·8	·4	·3	1·9	2·1
Cholera	·4	—	·6	—	—	·2
Small-pox	·5	·7	·9	·5	—	·6
Enteric fever	·5	·7	·1	·1	—	·4
Intermittent fever	233·1	297·6	223·6	350·6	231·0	274·5
Remittent fever	9·7	17·6	5·2	10·6	8·4	11·9
Simple continued fever	3·6	1·8	6·3	13·0	·3	5·1
Tubercle of the lungs	4·7	6·8	1·8	2·8	·5	4·3
Pneumonia	9·6	23·2	8·9	13·9	6·6	15·3
Other respiratory diseases	18·9	27·6	23·3	29·0	12·7	24·6
Dysentery	35·8	53·4	33·9	55·1	33·8	46·0
Diarrhœa	7·6	7·4	4·9	17·0	2·4	8·6
Hepatic abscess	·1	—	·2	·2	—	·1
„ congestion and inflammation ...	1·2	·6	2·0	1·4	·8	1·1
Scurvy	2·4	2·0	·4	5·6	·8	2·4
Venereal diseases	36·8	18·3	44·2	48·9	21·8	32·8
All Causes	628·6	746·5	704·2	855·9	518·1	718·0

* Excluding troops in China, Somaliland, and England (Indian Coronation Contingent), and including troops in Extra India not in the Indian Command, and also including the Delhi Manœuvres and Coronation Durbar Force, which is not included in the commands.

Ratios of Commands—continued.

—	Ratio per 1,000 of the Average Strength.					
	Bengal Command.	Punjab Command.	Madras Command.	Bombay Command.	Hyderabad Contingent.	Army of India.*
IV.—Death-rate of the Year :						
Cholera	·19	—	·33	—	—	·12
Small-pox	—	—	·06	·04	—	·02
Enteric fever	·15	·16	—	·04	—	·10
Intermittent fever	·98	·83	·83	1·07	·64	·89
Remittent fever	1·09	1·31	·72	1·19	1·61	1·14
Simple continued fever	—	—	·11	·04	—	·03
Circulatory diseases	·30	·21	·72	·29	·16	·35
Tubercle of the lungs	·86	1·17	·33	·70	·32	·80
Pneumonia	1·61	5·70	2·22	4·39	2·10	3·71
Other respiratory diseases	·41	·46	—	·33	—	·35
Dysentery	·34	·32	·39	·57	·32	·39
Diarrhœa	·26	·05	·33	·25	—	·18
Hepatic abscess	·11	·02	·06	·12	—	·06
Anæmia and debility	·15	·09	·17	·25	·48	·17
All Causes	8·03	12·76	12·77	11·65	9·83	11·16

* Excluding troops in China, Somaliland, and England (Indian Coronation Contingent), and including troops in Extra India not in the Indian Command, and also including the Delhi Manœuvres and Coronation Durbar Force, which is not included in the Commands.

Geographical groups.—Of the troops in the different groups (*see* Table on next page), those in the Assam group were the most unhealthy during the decennium 1891–1900, but during 1902 those in the Southern India group. The troops in the Burma Coast group during 1902 had the highest admission-rate from simple continued fever and the lowest from diarrhœa; those in the Burma Inland group the highest from non-pneumonic respiratory diseases and the lowest from remittent fever, pneumonia, and scurvy; those in the Assam group the highest from dysentery, diarrhœa, and cholera and the lowest from respiratory diseases other than pneumonia; those in the Bengal-Orissa group the lowest from small-pox and tubercle of the lungs; those in the Gangetic Plain group the lowest from ague; those in the Upper Sub-Himalaya group the lowest from cholera, influenza, and simple continued fever; those in the Indus Valley group the highest from pneumonia, remittent fever, and influenza, and the lowest from venereal diseases; those in the Central India group the highest from ague; those in the Western Coast group the highest from hepatitis; those in the Southern India group the highest from small-pox and cholera and the lowest from enteric fever and dysentery; those in the Hills group the highest from tubercle of the lungs.

Stations, regiments.—Among the large stations in India with an average annual strength of not less than 1,000, the highest death-rates recorded were in 1902 in Bangalore, chiefly on account of pneumonia and ague; Dera Ismail Khan, chiefly on account of pneumonia and ague; Aurangabad, chiefly on account of pneumonia, ague, and remittent fever; and Meean Meer, chiefly on account of pneumonia and remittent fever. Among the regiments the most unhealthy were the 28th Punjab Infantry at Waziristan and Delhi, the 17th Rajputs at Wana, the 4th Madras Infantry at Bangalore, the 23rd Pioneers in Waziristan and Meean Meer, the 38th Dogras in the Tochi Valley and Ferozepore, and the 3rd Madras Lancers at Bangalore. All these regiments suffered especially from ague, the 17th Rajputs suffered in addition from dysentery and the 28th Punjab Infantry from bronchitis.

Ratios of Geographical Groups.

—	Ratio per 1,000 of the Average Strength.												
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	
	Burma Coast and Bay Islands.	Burma Inland.	Assam.	Bengal and Orissa.	Gangetic Plain and Chutia Nagpur.	Upper Sub-Himalaya.	North-West Frontier, Indus Valley, and North-Western Rajputana.	South-East Rajputana, Central India, and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	Army of India.*
I.—Average Annual Strength	1,362	3,659	1,427	2,280	6,136	14,978	16,472	10,754	15,978	1,670	6,270	20,950	124,231
II.—Constantly-sick-rate of the Year.	26·2	33·3	32·2	33·7	21·2	22·9	32·1	33·5	23·9	27·4	31·8	32·5	26·6
III.—Admission-rate of the Year:													
Influenza	2·2	—	—	2·6	—	·5	3·9	1·0	·8	—	·6	3·5	2·1
Cholera	—	·3	1·4	—	1·0	·1	—	—	—	—	1·4	—	·2
Small-pox	—	—	—	·4	1·0	·9	1·2	·6	·4	1·2	1·6	·5	·6
Enteric fever	·7	—	1·4	—	·5	·3	·4	·3	—	—	·2	1·3	·4
Intermittent fever	254·8	422·0	270·5	382·0	140·8	227·3	374·1	424·1	242·2	219·8	227·6	328·7	274·5
Remittent fever	6·6	2·7	15·4	12·7	9·0	14·1	19·0	13·4	5·9	7·2	3·5	18·5	11·9
Simple continued fever ..	14·7	—	—	—	—	2·1	3·3	9·0	6·0	3·6	9·1	3·2	5·1
Tubercle of the lungs ..	2·2	1·6	9·1	·9	4·7	8·0	3·6	3·2	1·4	3·0	2·1	9·4	4·3
Pneumonia	2·2	1·9	2·8	3·5	8·0	20·1	21·7	15·3	6·8	10·8	13·1	20·5	15·3
Other respiratory diseases	33·8	42·4	9·8	25·0	18·6	20·8	28·2	26·0	15·0	28·7	20·6	27·5	24·6
Dysentery	76·4	53·0	77·1	72·8	37·8	28·9	58·9	28·8	29·3	37·7	24·2	56·3	46·0
Diarrhœa	2·2	11·8	14·7	13·6	5·4	5·3	6·9	6·6	4·5	9·0	4·8	14·6	8·6
Hepatic abscess	—	·5	—	—	·2	·1	·1	·2	·1	·6	—	—	·1
„ congestion and inflammation.	1·5	2·2	1·4	·4	·7	·6	·8	1·2	·8	4·2	1·6	2·2	1·1
Scurvy	—	·3	2·1	5·3	·5	1·4	3·7	3·8	·6	·6	1·0	3·9	2·4
Venereal diseases	77·8	23·0	28·0	52·2	23·3	25·0	22·5	63·2	45·8	53·3	50·1	31·9	32·8
All Causes ..	1,043·3	982·8	651·0	824·1	516·0	636·0	901·0	898·1	631·1	700·6	727·8	821·9	718·0
IV.—Death-rate of the Year:													
Cholera	—	—	·70	—	·49	—	—	—	—	—	·96	—	·12
Small-pox	—	—	—	—	—	—	·06	—	·06	—	—	—	·02
Enteric fever	—	—	—	—	·16	·13	—	·19	—	—	—	·29	·10
Intermittent fever	·73	1·37	1·40	3·07	1·14	·40	·97	1·30	·50	·60	·96	·86	·89
Remittent fever	—	·55	—	·88	·81	1·67	1·46	1·95	1·00	—	·64	1·10	1·14
Simple continued fever ..	—	—	—	—	—	—	—	—	·13	—	—	·05	·03
Circulatory diseases ..	—	·55	—	·44	·49	·20	·12	·09	·50	·60	·80	·38	·35
Tubercle of the lungs ..	—	—	1·40	·44	·33	1·13	·61	·65	·38	1·80	·32	2·20	·80
Pneumonia	·73	·55	—	·88	1·79	4·01	5·52	5·02	1·44	4·19	4·31	5·11	3·71
Other respiratory diseases	—	—	—	·88	·65	·33	·61	·37	—	1·20	—	·57	·35
Dysentery	·73	·27	2·80	·44	·16	—	·55	·28	·38	—	·64	·32	·39
Diarrhœa	—	·55	—	·44	·33	·13	·06	·09	·06	—	·64	·24	·18
Hepatic abscess	—	—	—	—	·16	·13	—	·19	·06	—	—	·10	·06
Anæmia and debility ..	—	·27	—	—	·16	—	—	·37	·19	·60	·16	·33	·17
All Causes ..	5·14	6·56	8·41	8·33	8·15	9·15	12·81	12·55	8·64	11·38	22·33	13·70	11·16

* *See* footnote to Table on p. 58.

Influenza.—The admission ratio on account of influenza among native troops, as among European troops, was much lower during 1902 than during 1901. The month of maximum prevalence of the disease in 1902, as in 1901, was February. The largest numbers of admissions were recorded among the troops on the Mahsud Blockade and among the troops at Kohat, Bakloh, and Dharmsala. The native troops suffered slightly more than the European troops, but much less than the prisoners.

Cholera.—There were 26 cases of cholera with 15 deaths during 1902, as compared with 35 cases with 19 deaths during 1901, and the admission and death-rates were much below the decennial rates. The month of maximum prevalence of the disease was February, but, as in 1901, cases occurred during eight months of the year. The most important outbreak was that of eight cases at Trichinopoly, all of which occurred among the men of the 1st Moplah Rifles. Six cases with three deaths occurred among the men of the 8th Bombay Infantry at Dinapore. All the men attacked contracted the disease outside the station while visiting the Sonepore fair. Two cases occurred among the men of the 21st Punjab Infantry at Tientsin, in which city the disease was very prevalent. Nothing is said by the medical officers regarding the cases occurring in other regiments.

Small-pox.—There were 75 admissions on account of small-pox with two deaths, as compared with 55 admissions with four deaths in the previous year, and the admission ratio during 1902 was above that for the decennium. The largest numbers of admissions were seven at Dera Ismail Khan, six at Bangalore, five at Baroda, and five at Secunderabad. The largest number of cases occurring in one regiment was five in the 9th Bombay Infantry at Baroda. All these five cases occurred among a batch of recruits who had newly joined the regimental depôt, one of whom had no marks of either small-pox or vaccination. Three cases occurred among the men of the 35th Sikhs, one at Nowshera and two at Dera Ismail Khan. All three men bore satisfactory marks of vaccination.

Ague, remittent fever, simple continued fever.—Intermittent fever accounted for over 38 per cent. of the total number of admissions from all causes among the native army; but the admission ratio was lowered as compared with that of 1901 by 83·9 per 1,000. The admission-rates returned from nine of the geographical groups were lower, and from three higher than those of the previous year. The most malarious group during 1902 was the South-East Rajputana and Central India group, though the admission-rate recorded among the native troops in this group was lower than in 1901. The greatest increase in the ague admission-rate occurred among the troops in the Burma Coast group. For all the native troops in India the most malarious month was October, and the least malarious March. Of the stations at which the average annual strength was over 100, those at which the admission-rates on account of ague were over 1,000 per 1,000 were, in order, Keng Tung, Datta Khel, Deesa, Miran Shah, and Ahmedabad. The greatest numbers of admissions were recorded among the men of the 5th Punjab Infantry and the 12th Bombay Infantry. The 5th Punjab Infantry was stationed in the Tochi Valley, where malaria is very prevalent—as a result, in the medical officer's opinion, of the large amount of irrigated rice and maize land in the vicinity. No measures for the destruction of mosquitoes were undertaken; but during the fever season, which lasted from June till the end of November, a prophylactic dose of 3 grains of quinine was issued to the men three times a week. At Deesa, where the 12th Bombay Infantry was stationed, the months of September, October, and November were said to have been extremely malarious in spite of great efforts having been made to limit the breeding of *anopheles* mosquitoes. Scrupulous attention was paid to keeping all drains and water-courses clean and to prevent water lodging in pools. Fire buckets were regularly emptied out and kerosene oil applied to pools and waste water receptacles. The increase in the prevalence of the disease was attributed chiefly to the close proximity of the Banas river—a small stream flowing in a wide sandy bed in which cultivation is carried on. The edge of the stream is luxuriant with grass and weeds, and small pools of water and irrigation channels are numerous in the cultivated patches, providing very favourable breeding grounds of *anopheles* mosquitoes. The prevalence of ague among the men of the 28th Punjab Infantry at Delhi was attributed to the fact that after the monsoon a large number of pools of stagnant water, in which *anopheles* mosquitoes breed freely, form along the banks of the river. A prophylactic dose of 5 grains of quinine was issued every other day to the men from the 1st September to the end of October. Major Melville, R.A.M.C., the Sanitary Officer of the Madras Command, was deputed to enquire into the cause of the excessive prevalence of malaria among the men of the 4th Madras Pioneers at Bangalore. He found *anopheles* mosquitoes breeding in large numbers in a "tank" near one of the barracks, in the small pools of water on the granite rocks, and in other situations in the lines. He recommended that the lines should be vacated for two or three months, and that measures directed against the mosquitoes in the different breeding places should be carried out. The regiment was accordingly moved into

camp on the 22nd of November, but the men having previously suffered so much from malaria little decrease in the number of admissions was noted before the end of the year.

Remittent fever accounted for over 10 per cent. of the total number of deaths among the native army during 1902. The disease was most prevalent in April and least so in November, though there was no month during which the number of admissions was less than 98. The admission and death rates during 1902 were lower than those of the previous year. The disease was most prevalent in the Indus Valley, the Hills, the Assam, and the Upper Sub-Himalaya groups. The greatest numbers of admissions were recorded at Kohat, Edwardesabad, and Dharmsala. Among regiments, those with the highest numbers of admissions for this disease were the 29th Punjab Infantry at Dera Ismail Khan and the 1st Battalion 1st Gurkhas at Dharmsala.

The largest numbers of admissions on account of simple continued fever were returned from among the men of the 2nd Bombay Lancers at Deesa and the 1st Bombay Lancers at Poona. The medical officer of the former regiment says that the large proportion of cases must be attributed chiefly to fatigue and exposure on the march from Deesa to Loralai.

Enteric fever.—The admission-rate on account of enteric fever during 1902 was double that of 1901, but the death-rate was slightly lower. Though both the number of admissions recorded and the admission ratio were slightly higher during 1902 than the average figures for the preceding ten years, the ratios for native troops are, as usual, very unlike those for European troops, as are also the ratios for native prisoners. The statistics do not reflect the opinion, so prominent of late, that enteric fever is quite common among *adult* natives of India. The admission ratio per 1,000 from enteric fever among European troops was 16·7 and the death ratio 4·29. For native troops the corresponding figures were ·4 and ·10, and for prisoners ·6 and ·13. By those who consider that enteric fever is common among natives the small number of cases recorded among native troops and prisoners is usually accounted for on the supposition that enteric fever, when it occurs among these classes of people, is not correctly diagnosed, but is returned under the heading of some other fever, such as ague, remittent fever, or simple continued fever. If this were the case we should expect the death-rates from these other fevers to be high. The death-rates of all the diseases under which cases of enteric fever might possibly be returned may be compared with regard to European troops, native troops, and prisoners, by means of the accompanying table.

——	European troops. Deaths per 1000, 1902.	Native troops. Deaths per 1000, 1902.	Prisoners. Deaths per 1000, 1902.
Enteric fever	4·29	·10	·13
Intermittent fever	·50	·89	1·10
Remittent fever	·20	1·14	·78
Simple continued fever	·00	·03	·01
Total fever mortality	4·99	2·17	2·02

From this it will be seen that taking either native troops or prisoners their mortality *from all fevers* was considerably below that of the European troops *from enteric fever alone.* Indeed we might add up the total fever death-rates of native troops and of prisoners and the result would still be below the death-rate of European troops from enteric fever alone. The conclusion to be drawn from these figures is sufficiently obvious.

In a paper read before the Royal Medical and Chirurgical Society, Captain Rogers, I.M.S., stated that in the course of 18 months he had diagnosed 26 cases of continued fever in natives admitted into the Medical College Hospital, Calcutta, as enteric fever, and recorded his opinion that only two forms of long-continued fever exist in natives of India, viz., typhoid fever and malarial remittent fever—upwards of 80 per cent. of

continued and remittent fevers occurring in natives of India which lasted three weeks or more being typhoid fever. He considered that typhoid fever in natives differed in no noteworthy respect from the same disease occurring in Europeans in this country, except that the cases tended to be more severe and fatal in natives than in Europeans—a conclusion which is not borne out by the statistics referred to above. His methods of research and his conclusions were severely criticised by Manson, Wright, and Low. Lieutenant-Colonel Henderson, I.M.S., and Major Childe, I.M.S., have also described cases occurring in natives of India, and Major Meyer, I.M.S., has published notes of seven cases—two Brahmins, one Parsi, one Mohamedan, two Goanese, and one Bombay East Indian. Lieutenant McCarrison, I.M.S., has written of the disease as it occurs among Gurkhas, and Maxwell has published cases occurring among the natives of Southern China, where, he says, the disease is endemic among the native population. He had, however, never met with a serious epidemic of the disease, and never with a case in a child under 12 years of age. The spread of the disease from person to person appeared to take place chiefly, if not entirely, by direct infection. Kennard has recorded his opinion that typhoid fever is rare among the natives of British Guiana.

Among the whole native army of India 50 admissions with 12 deaths were returned during 1902, as compared with 26 admissions with 15 deaths during 1901. Kila Drosh, Abbottabad, Lansdowne, Dharmsala, and Kohat returned the highest numbers of cases. Thirty-one regiments contributed to the total, the largest number of cases in any regiment being eight in the 2nd Battalion 2nd Gurkha Rifles at Kila Drosh. In two of the cases occurring in this regiment the diagnosis was confirmed at a post mortem examination. The medical officer attributes the disease to impure milk drunk on the march. A post mortem examination confirmed the diagnosis in one of the cases occurring in the 1st Battalion 2nd Gurkhas. In this case it was supposed that infection was contracted at Miran Shah, in the Tochi Valley. The medical officer remarks that cases occurring in this regiment are generally imported, or occur in men very recently joined. One of the cases occurring in the 2nd Battalion 39th Garhwal Rifles, at Lansdowne, also was admitted shortly after enlistment, and most probably contracted the disease outside the station. One of the cases occurring in the 2nd Battalion 5th Gurkhas was contracted while on duty in the Boer camp at Kakool, where the disease was very prevalent.

Four cases of Malta fever were returned—two from the 9th Bengal Lancers, and one each from the 4th Rajputs and 40th Pathans. No remarks on these cases are made by the medical officers of the regiments.

Plague. Cerebrospinal fever.—During 1902 there were 192 cases (158 admitted to hospital) of plague with 95 deaths, as compared with 70 cases with 41 deaths during 1901, 56 cases with 29 deaths during 1900, 76 cases with 45 deaths during 1899, and 94 cases with 58 deaths during 1898. The largest number of cases in any station was 81 at Bangalore, occurring in the 4th Madras Pioneers, the 3rd Madras Lancers, the Madras Sappers and Miners, and the 11th Coorg Infantry. The medical officer of the 4th Madras Pioneers says that many of the married men, who were not allowed to keep their families in the lines, kept them in the previously affected localities of the cantonment, and that in this way the disease spread to the lines. Out of the 33 cases occurring in this regiment, 14 had been inoculated: of these 6 recovered, 5 died, and 3 remained under treatment at the end of the year. Of the 19 uninoculated cases, 14 died, 3 recovered, and 2 remained under treatment. The disease was very prevalent amongst the families and followers of the 3rd Madras Lancers at Bangalore, and 24 attacks with 17 deaths occurred among the men. All the men and followers were inoculated and the regiment moved into camp, which checked the spread of the disease at once. Two cases occurred among the inoculated men of the 11th Coorg Infantry, one of which proved fatal.

Cerebrospinal fever decreased from 28 admissions with 21 deaths during 1901, to 18 cases with 17 deaths during 1902. The largest numbers of cases were five among the troops employed on the Mahsud Blockade, and four in the 29th Punjab Infantry at Sarwekai. There were also two each at Miran Shah and Ajmer, and one each at Jullundur, Ferozepore, Myitkyina, Kamptee, and Loralai. The medical officer of the 4th Sikh Infantry says that cerebrospinal fever appears to be always present among the civil population of Miran Shah and the neighbourhood, and from time to time the disease carries off men in the regiments there. Three cases of the disease among the civil population had been observed by him about the time of the occurrence of the regimental cases. Of the cases among the troops employed on the Mahsud Blockade and of those occurring in the other regiments mentioned above, nothing is said by the medical officers.

Tubercle of the lungs.—Although there was a slight rise in the admission ratio on account of tubercle of the lungs as compared with that of the previous year, the death-rate was slightly diminished. The admission-rates recorded among the troops in the Punjab and Madras Commands were higher than those of 1901. Of the geographical groups, the admission ratios returned from the Hills, the Assam, and the Upper Sub-Himalaya groups were much the highest for the year; and of the Commands, Hyderabad and Madras returned the lowest death ratios. Four out of the six highest admission numbers were recorded among Gurkha regiments, and two among Bengal Lancer regiments. The highest number of admissions during the year occurred in the 1st Battalion, 4th Gurkha Rifles, at Bakloh. The medical officer of the regiment records his opinion that Gurkhas have a special hereditary susceptibility to the disease, and considers that the immediate cause is the inhalation by susceptible persons of infected dust from the mud floors of the barrack-rooms. The floor space per man of the barrack-rooms of this regiment is below that prescribed by regulations. The medical officer of the 1st Bengal Lancers at Lucknow attributes the prevalence of the disease to the fact that the regiment spent the previous winter at Hong Kong, and contrasts the somewhat high prevalence of the disease in his regiment with the very low prevalence in the 7th Rajputs, who also wintered in China, but were stationed in the north where the cold was intense but the air dry and bracing. A marked increase in the number of cases of tubercle of the lungs occurred in the 11th Bengal Lancers at Meean Meer. The medical officer considers it to be due entirely to the complete absence of any means of ventilation in the men's quarters. He states that in these quarters there are no outlets or inlets for air except those left by badly fitting doors, and that, owing to some of the syces having to occupy the same rooms as the soldiers, the cubic space per man is very deficient.

Twenty-three admissions with one death were returned as non-tubercular phthisis during 1902, as compared with 13 admissions with three deaths during 1901.

Pneumonia and other respiratory diseases.—During 1901 there was an increase in the prevalence of influenza and a fall in the admission and death ratios from pneumonia. During 1902 these relations were reversed, a considerable decrease in influenza being accompanied by an increase in the admission and death rates from pneumonia. During 1902 pneumonia caused over 33 per cent. of the total number of deaths, and was, as usual, the chief cause of death. The admission ratios were, as usual, highest among the troops in groups VII. and XII., that of the troops in group VI coming next. In these three groups, as well as for India as a whole, pneumonia was most prevalent during the cold months, especially in December, January, and February. Admission ratios over 50 per 1,000 were recorded among the troops stationed at Wana, Mir Ali Khel, Tank, Sibi, Ootacamund, Mercara, and Jullundur; and death ratios over 20 per 1,000 at Wana, Tank, Mir Ali Khel, and Sibi. The largest number of cases occurred among the 17th Rajputs at Wana, the disease appearing in epidemic form during the latter part of the year. The medical officer of the 2nd Sikhs at Kohat attributes the prevalence of pneumonia to the fact that the men leave their quarters insufficiently clad in the early morning to perform their ablutions, a severe chill resulting in some cases. The disease was most prevalent in the 1st Sikh Infantry at Kohat during December, January, and February, and seemed to attack the strong as readily as the weaker men. The 21st Madras Pioneers suffered chiefly while employed on the North-West Frontier, where the cold was severe. The disease was also prevalent and of a severe type in the 43rd Gurkha Rifles at Shillong and the 20th Punjab Infantry at Meean Meer.

Other respiratory diseases were most prevalent in the Bombay Command and in the Burma Inland, Burma Coast, and Western Coast groups. Omitting stations at which the average annual strength was less than 100, Wana was the only station at which an admission-rate of over 100 per 1,000 of strength was recorded. Stations returning death ratios of over 5 per 1,000 were Tank and Kajuri Kach. The 30th Burma Infantry at Bhamo, the 1st Bombay Grenadiers at Aden, and the 28th Bombay Pioneers at Khusalgarh and Quetta, had considerably the highest numbers of admissions; the 27th Rajputs at Wana and the 6th Bombay Cavalry at Fort Sandeman coming next. The medical officer of the 1st Bombay Grenadiers at Aden says that most of the men who suffered from bronchitis had had the disease several times before, and that dust may have been an exciting cause of the attacks.

Dysentery and diarrhœa.—The admission and the death-rate on account of dysentery were higher during 1902 than during 1901. Increased admission-rates were returned from all the groups, except the Gangetic Plain, the Upper Sub-Himalaya, the Western

Coast, and the Southern India groups. Of the 16 stations of over 100 strength at which admission ratios above 100 per 1,000 were recorded, seven were in the Hills, five in the Indus Valley, and one each in the Assam, the Bengal-Orissa, and the Gangetic Plain groups. At Aden also an admission-rate of over 100 per 1,000 was recorded. The highest admission ratios were returned from Aden, Datta Khel, Barrackpore, and Mir Ali Khel; and the highest death ratios from Silchar and Aden. The 1st Bombay Grenadiers at Aden had the largest number of admissions, the 17th Rajputs at Wana coming next. The medical officer of the 1st Bombay Grenadiers says that dysentery cases were due partly to bad food and partly to the fact that owing to the pollution of the ground by the native population, the dust blown about by the wind was contaminated with dried fæces. A large number of cases of dysentery of a mild type occurred among the 16th Rajputs soon after their arrival at Alipore. The food stuffs in the bazaar were found to be of good quality, and it was suggested that, owing to the dearness of fuel, the men did not cook their food properly. After the issue of an order urging the men to thoroughly cook their food, a marked diminution in the number of cases of dysentery and diarrhœa was observed. Dysentery prevailed, as usual, more during the second half of the year than the first, the months of greatest prevalence being July, August, and December.

Though the admission ratio on account of diarrhœa during 1902 was slightly lower than during 1901, the death ratio was twice as high. The disease was most prevalent in the Assam and the Hills groups. Of stations in the Assam group, Manipur returned the highest ratio, and of those in the Hills, Loralai. The ratios recorded at Aden, Peshin, Fort Stedman, Tank, Fort Sandeman, Doranda, Barrackpore, Delhi, and Mir Ali Khel, were, however, all higher than that at Manipur, though lower than that at Loralai. The highest death ratios were recorded at St. Thomas' Mount, Dinapore, Fort Stedman, and Barrackpore. The cases of diarrhœa at Loralai were attributed to a bad water-supply; and towards the end of the year a new supply was installed to check the prevalence of the disease. At Aden bowel-complaints were attributed to chills resulting from insufficient precautions being taken by the men to guard against the cold wind blowing in the evening.

Venereal diseases.—Venereal diseases were nearly nine times as prevalent among European troops during 1902 as among native troops. While among European troops an average annual strength of 60,540 gave 17,036 admissions, in the case of native troops an average annual strength of 124,231 gave only 4,071 admissions. In other words, there were only 33 admissions into hospital for every 1,000 men among native troops, as compared with 281 admissions for every 1,000 men among British troops. Among all the native troops in India the admission-rate during 1902 was 1·5 per 1,000 less than during 1901. There were nine deaths and 121 invalidings directly due to venereal disease. The admission-rates among troops in the Bombay and Madras Commands were the highest for the year; but, as compared with 1901, the admission-rates returned from all the commands except Bengal, as well as the rate among the troops of the Hyderabad Contingent, showed a decrease, the greatest decrease being noted in the admission-rate of the troops of the Hyderabad Contingent.

Beri-beri.—There were in all 84 cases of beri-beri during 1902, 83 having occurred among the Madras regiments, and one in a Bombay regiment, as compared with 108 cases, all among the Madras regiments, during 1901. The 3rd and the 13th Madras Infantry regiments at Singapore had between them the highest number of admissions (34), the 7th Madras Infantry at Vizianagram coming next. Probably on account of the lesser prevalence of the disease during 1902 medical officers have said little or nothing about it in their reports, the only point worthy of note being the fact that in some regiments the disease prevailed chiefly among the recruits.

No advance in our knowledge of the causation of beri-beri that is worthy of record has been made during the year under review. McClosky found that the administration of arsenic to beri-beri patients did not produce any good effects, nor did it aggravate the disease, and concludes for this reason that it cannot be the causative agent. Bertrand, moreover, has shown that arsenic is normally present in all animal tissues, and that the skin, hair, and nails are particularly rich in it.

Jails of India.

Sickness and mortality in 1902.—The year 1902 was hot and rather dry, the rainfall being, however, only very slightly deficient. The monsoon began feebly, but the rainfall over the greater part of the country in July was approximately normal. In August there was a long break in the rains, followed in September by a rainfall in excess of the average in practically all parts of the country. The health of the general population and of the prisoners was good.

The chief causes of admission to hospital were ague, dysentery, abscess, and diarrhœa. The only diseases with raised admission-rates as compared with those of the previous year were tubercle of the lungs and enteric fever. Ague accounted for 41 per cent. of the total number of admissions, and bowel-complaints for 16 per cent. The chief causes of death were dysentery, tubercle of the lungs, and pneumonia. Among the diseases with lowered mortality were dysentery, cholera, and pneumonia. Dysentery and diarrhœa caused 26 per cent. of the total deaths, tubercle of the lungs 17 per cent., and pneumonia 14 per cent.

Administrations.—The health statistics of the prisoners in all administrations except in the Andamans, the North-West Frontier Province and the Central Provinces, were more favourable than those of the previous year. The most unhealthy administrations were, in order, the Andamans, Bengal, Assam, the Punjab, and the North-West Frontier Province; and the three most healthy, in order, Madras, Burma, and Berar. Of the former group the first, fourth, and fifth were more unhealthy than in the quinquennium. As compared both with the previous year and with the quinquennium, the year 1902 had increase of mortality in the Andamans from remittent fever, tubercle of the lungs, pneumonia, other respiratory diseases, and dysentery; in Burma from respiratory diseases other than pneumonia; in Assam from tubercle of the lungs and pneumonia; in the Punjab from tubercle of the lungs, pneumonia, diarrhœa, remittent fever and small-pox; in the North-West Frontier Province from pneumonia, tubercle of the lungs, and dysentery. Thus, four of the provinces just mentioned had increased mortality from tubercle of the lungs and pneumonia, as compared both with the previous year and the quinquennium.

Andamans.—The rainfall of 1902 was heavy, six inches more than in 1901, and 25 inches more than the average of the preceding five years. The unhealthiness which marked the year is stated not to have been confined to the convicts and the police, but to have affected all classes of the community. The free population suffered much from malaria, and it is said that phthisis is increasing among them. Besides the general medical and sanitary report, the senior medical officer submitted separate special reports on malaria, on tubercle of the lungs, and on dysentery, the three scourges of the settlement. He pointed out that sickness and mortality were highest wherever hard work and exposure in the open were most in force. Frequent use was made of the microscope in the diagnosis of malaria and tubercle. The type of malaria in the female jail is said to be more virulent than in previous years, and many of the children harbour malarial parasites. Recently admitted prisoners suffered most from remittent fever. The measures adopted more or less extensively, and believed to have obtained a certain amount of success, were the institution of mosquito brigades, the use of mosquito nets, the prophylactic issue of quinine, and the protection of prisoners from the risk of exposure. With regard to the prevalence of tubercle of the lungs, it was shown that the floor space per prisoner is not sufficient and that four rows of prisoners sleep in a barrack, and that care is not taken to ensure that clothing is dry. It was proposed to facilitate the early detection of cases by frequent inspections and regular weighments, and sanction had been asked for the necessary increase in establishment. A special ward to hold fifty phthisis patients was nearly ready for occupation, but another is needed. As to accommodation, it was proposed to begin with the invalid and convalescent gangs, and obtain for them, by building, a floor space of 50 square feet per man. Arrangements were made, or proposed, to keep clothing dry, to disinfect barracks from which cases came, to boil infected clothing, to watch over the milk supply, and to inform prisoners regarding the nature of the disease and the danger of infection.

The stools of patients suffering from phthisis and dysentery were burned in special incinerators at the various hospitals.

The classes which suffered most from dysentery were the invalids, the prisoners recently admitted, and those employed on hard outdoor labour. Infection was considered to occur directly, through the soil, or by the medium of flies. Since the adoption of

Prisoners.

Administrations.	Years.	Average Strength.†	Ratio per 1,000 of Strength.*											
			Admissions.	Constantly Sick.	Deaths from									
					Cholera.	Small-pox.	Remittent Fever.	Tubercle of the Lungs.	Pneumonia.	Other Respiratory Diseases.	Dysentery.	Diarrhœa.	Anæmia and Debility.	All Causes.
Andamans ...	1896–1900	10,975	1,689	51	—	—	3·17	5·50	2·48	1·02	10·04	2·26	2·00	32·31
	1901	12,183	1,683	51	—	—	2·87	6·57	4·10	·98	11·98	2·05	·08	36·94
	1902	12,907	1,797	56	—	—	3·80	9·61	4·34	1·78	13·87	1·86	—	42·07
Burma ...	1896–1900	13,127	626	30	2·00	·14	·44	3·84	2·04	·43	4·27	·90	·46	20·54
	1901	11,840	551	26	1·44	—	·17	4·31	1·18	·25	2·28	·17	·17	15·29
	1902	11,525	537	25	—	—	·43	3·82	1·65	·87	2·95	·43	·26	15·88
Assam ...	1896–1900	1,284	961	49	4·67	—	2·65	1·40	2·65	1·71	8·88	4·05	3·58	44·24
	1901	1,338	1,022	45	·75	—	2·99	—	·75	·75	5·98	2·99	3·74	26·16
	1902	1,220	762	40	·82	—	2·46	2·46	3·28	—	7·38	—	3·28	31·97
Bengal ...	1896–1900	18,121	1,057	37	2·40	·03	·96	3·77	3·60	·91	7·75	1·57	·96	30·11
	1901	20,149	1,090	39	·89	·10	·35	3·72	2·83	·74	8·14	1·09	·40	27·59
	1902	20,580	1,034	41	·53	·05	·39	3·50	3·06	·53	6·12	1·55	·92	25·61
United Provinces of Agra and Oudh.	1896–1900	32,128	883	45	·47	·07	·47	2·71	4·86	1·00	6·09	2·04	2·66	27·86
	1901	29,311	840	40	1·13	—	·07	3·68	2·46	1·19	5·87	1·23	·48	24·29
	1902	27,751	735	35	·32	·04	·14	3·35	2·20	·76	4·94	1·77	·07	20·47
Punjab (*a*) ...	1896–1900	12,081	1,253	33	·22	·10	·55	2·83	4·87	·74	3·24	·96	·36	19·83
	1901	13,469	1,251	38	—	—	·45	3·04	5·12	·45	4·68	1·04	1·11	27·03
	1902	12,782	1,136	35	—	·23	·70	4·46	5·71	·55	2·74	1·17	·86	25·04
North - West Frontier Province.	1896–1900	1,178	1,225	41	—	—	1·87	·68	4·24	1·02	2·21	1·87	—	19·35
	1901	1,248	953	30	—	4·01	—	—	4·81	·80	4·01	—	—	22·44
	1902	1,290	975	32	—	—	—	2·33	7·75	—	5·43	·78	—	29·46
Bombay ...	1896–1900	8,759	773	29	3·27	·09	2·44	2·74	6·12	1·35	3·27	3·04	1·46	33·72
	1901	10,270	994	37	—	·29	1·56	3·80	10·02	1·95	2·63	1·85	1·46	36·12
	1902	9,898	648	31	—	—	·91	3·44	5·76	1·72	1·62	2·63	1·01	28·89
Berar and Secunderabad.	1896–1900	1,659	637	19	1·93	—	·36	1·57	5·30	4·10	6·75	2·89	3·25	36·05
	1901	1,483	676	20	—	—	·67	2·02	6·74	3·37	2·02	·67	2·70	24·95
	1902	1,175	783	19	—	—	—	—	4·26	1·70	—	2·55	·85	17·87
Central Provinces.	1896–1900	5,583	1,072	45	3·51	·25	1·22	4·12	5·30	1·40	30·49	9·78	5·02	74·23
	1901	4,802	864	29	—	—	—	2·50	3·12	1·46	7·91	4·79	2·29	27·49
	1902	4,148	972	32	—	—	·24	3·86	3·14	·72	5·06	2·17	·72	24·83
Madras ...	1896–1900	8,870	646	27	5·30	·11	·14	3·56	2·37	·54	4·10	·05	·34	28·30
	1901	10,456	593	25	3·54	—	·10	4·11	2·10	·10	2·87	—	·29	23·34
	1902	10,382	469	22	·29	·10	·10	3·85	2·02	·10	1·83	·10	·58	18·49
India‡ ...	1896–1900	114,293	981	38	1·68	·08	1·03	3·35	4·02	·94	7·04	2·10	1·67	29·97
	1901	117,203	981	37	·90	·09	·65	3·86	3·61	·93	5·85	1·34	·71	26·87
	1902	114,334	913	35	·21	·05	·78	4·25	3·38	·85	5·13	1·44	·52	24·85
	1891–1900	108,606	1,024	39	1·99	·08	1·20	2·98	4·27	1·09	6·81	2·18	1·78	30·29

* The quinquennial and decennial ratios are, of course, worked on the total strength of the five-year and ten-year periods respectively.

† Excluding subsidiary jails.

‡ Including Ajmer, Quetta, and Mercara.

(*a*) Excluding jails transferred to North-West Frontier Province.

special dysentery wards with separate latrines and disinfecting apparatus for the hospitals, hospital-dysentery is stated to have become uncommon. The senior medical officer would add a separate dysentery convalescent gang, as an additional means of preventing the spread of infection. Efforts are also being made to ensure that clothes worn by the prisoners are thoroughly dry. The frequency of self-induced dysentery is noted, and a list of the principal irritants taken with the object of inducing this disease is given. At every station there is a boiler, from which a plentiful supply of boiled drinking water is available. Reforms were carried out in the dieting and cooking, in the milk supply, and in the vegetable ration. Vegetables were divided into first class and second class in respect of their antiscorbutic value, and orders were issued that at least one-third of the rations should be of the first class. Scurvy is stated to be rare in the settlement now-a-days, and the gum affections which occur are put down to malaria and to the fact that prisoners do not pay sufficient attention to the cleanliness of their mouths and teeth. All the measures enumerated are good on paper but the result depends on how they are carried out. In the meantime the statistics of sickness and mortality do not indicate even the beginning of success.

Burma.—The health of the Burma prisoners, like that of the general population, was better than in the preceding years, the admission and constantly sick ratios being the lowest on record. Occasional overcrowding occurred in district jails, but was relieved by transfer. Boiling and permanganating of water is carried out in all the jails of the province. There is room for improvement in the method of distributing water in some of the jails; but in the central prisons and in some of the district jails it is pumped up and then distributed by pipes, to prevent contamination by handling. In the Ma-ubin jail the "meat-safe arrangement" to protect the prisoners from mosquitoes rendered the atmosphere of the wards very stuffy. The arrangement should be abandoned, and more trust put in quinine. There was a marked improvement in the health of the Moulmein jail. On the other hand, the Rangoon jail was considered to be showing signs of unhealthiness. For the first time in ten years, cholera did not make its appearance in any of the jails.* As a rule, cases of tubercle of the lungs, dysentery, and pneumonia were isolated. Separate "tubercle" wards exist in ten jails, and the question of the desirability of separate tubercle jails is being considered. The practice of producing abscess by the use of a poisoned seton was detected in the Monywa jail. The reduction of dysentery in the Moulmein jail was attributed to the facts that no water is now drunk in that jail unless it is first boiled, and that the water of the distrusted workyard wells has been rendered unpalatable by treating it with coal-tar. The scurvy admission-rate of Burma, though lowered, continued high, and was surpassed by that of Bombay only.

Assam.—The general health in the province of Assam was "extremely good." The sick ratios of the prisoners were also low, but an outbreak of "beri-beri"† in the Gauhati jail caused some increase of the death-rate. Special precautions were taken in the case of prisoners suffering from tubercle of the lungs. A committee was appointed to inquire into the causes of the unhealthiness of the subsidiary jail at Kohima. Among administrations, Assam had the highest death-rate from ague, and from anæmia and debility, and a high death-rate from dysentery; but a low death-rate from tubercle of the lungs. There was only one case of cholera. It occurred at Silchar, in the person of a man who had just travelled from Aijal.

Bengal.—The health of the general population of the Bengal Province was bad, but that of the prisoners was, on the whole, somewhat improved, and the death-rate lower than in preceding years. There was, as usual, a high death-rate from dysentery, but it was not the highest. The jail population increased and overcrowding consequently occurred in some of the jails. In most jails the question of water supply has been satisfactorily solved. There are Pasteur filters in eight jails, but on the whole they have not given satisfaction. With regard to the eight jails with the highest death-rates, the causes most frequently mentioned were, in order, poor health of prisoners on admission, overcrowding, defective water supply, dampness of a barrack. The Barisal jail was visited by an outbreak of epidemic dropsy. There occurred 12 cases of cholera distributed over 10 jails, and two cases also occurred in subsidiary jails. The disease was usually prevailing in the neigbourhood of the jail; and most of the prisoners affected were men under trial, or recently admitted into jail, or into the quarantine wards of the jail.

---

* There were two cases of "choleraic diarrhœa." † Returned as "multiple neuritis."

Where two cases occurred, no connection was discovered between them. At Monghyr a paid warder, who was supposed to have drunk infected milk, was first attacked. Every jail patient and his contacts were isolated, and, where necessary, a barrack was evacuated and disinfected. No less than 20 jails were without a death from dysentery, but malaria was more prevalent and severe. The Inspector-General believes that the statistical increase in tubercle of the lungs is the result of greater care in the correct registration of disease, and of the recognition that it is a common affection of the free population and of prisoners at the time of admission to jail. In most jails cases were isolated, and treated, as far as possible, in the open air ; while care was taken to provide spittoons, and to disinfect clothes and bedding used by phthisical patients. The Inspector-General notes in this connection that the floor space allowed per prisoner in wards does not err on the side of liberality, being less than that considered necessary for the native soldier ; and that for this reason a full ward is not very far removed from being an overcrowded one. In speaking of the Rangpur jail, an unhealthy one, he remarks that " in wards with ten rows of prisoners the floor space should be much more than it is." But there ought never to be ten rows of prisoners in a barrack ; no modern ward should contain more than two rows. The four and ten row barracks which exist in the Andamans and Bengal are a sanitary mistake, and are no doubt responsible for much avoidable sickness.

United Provinces.—The death-rate among the general population of the United Provinces was higher than in 1901, although not far removed from the average, and the prisoners had an unusually low death-rate. There was decided improvement in the health of five formerly unhealthy district jails, ascribed in the case of Moradabad partly to reforms in the water supply and in site ventilation. Among the causes mentioned for high death-rates in individual jails the most frequent are the poor health of prisoners on admission into jail and defective water supply. The site ventilation of several jails was improved by lowering internal walls and removing unnecessary walls and buildings. Pumps were provided for the wells, and other measures taken to improve the water supply and prevent pollution during distribution, in the Fatehgarh Central Prison and in eight district jails ; and the two Benares jails are being connected with the municipal waterworks. On the whole, the accommodation was more than sufficient for the daily average number of prisoners. Night latrines are being provided gradually for all barracks. The isolation of cases of tubercle was believed to have already produced good results in the Agra Central Prison. The isolation of dysentery patients and the disinfection and incineration of their evacuations were more carefully attended to than formerly. Plague occurred in three jails, and cerebrospinal fever in four. In the Benares Central Prison cholera caused 12 admissions and six deaths. The epidemic was soon checked by movement into camp. How the jail became infected is not known ; but the disease prevailed in the surrounding villages, and the medical officer mentions as a possible source that a tank outside the jail communicates with one inside, and that the first man attacked, as well as two others, were on duty near the latter tank. A sweeper, who removed the cholera excreta was among those attacked. In the infirm gang of the Ghazipur jail three cases and two deaths were recorded, and in another barrack a fatal case. The origin could not be traced, but there were cases in the city and neighbourhood at the time. The disinfectant measures adopted by the medical officer for the barracks had special reference to the destruction of flies.

Punjab.—The increased mortality among the general population of the Punjab was due to plague, there having been hardly any cholera, less fever, and the same proportion of bowel complaints. Though the disease extended so widely in the Punjab, only three deaths from plague occurred in jails. Cerebrospinal fever, on the other hand, was more frequently imported into jails from outside. The general health of the prisoners was considerably better than in the preceding year ; but the constantly sick and death-rates do not compare favourably with those of the quinquennium. As compared with 1901 there was increased mortality from small-pox, remittent fever, tubercle of the lungs, pneumonia, other respiratory diseases, and diarrhœa ; but a considerable decrease in dysentery and debility. Overcrowding, when it occurred, was met by transfer or by the use of tents. Improvement of the lateral ventilation of cells and barracks has been taken in hand, and is well advanced. Various improvements were also carried out or arranged for in the water supply of jails. High mortality in individual jails was in three cases due to cerebrospinal fever. Quinine prophylaxis was carried out in all jails, but not always with sufficient system or earnestness. A beginning has been made in the provision of special tubercle wards, and further projects are under consideration ; and much is expected from the improvement in lateral ventilation. There was no cholera in the Punjab jails.

North-West Frontier Province.—As regards the health of the inhabitants of the North-West Frontier Province the year was a favourable one ; for, though there was more fever and small-pox, there was no cholera, and very little plague. The jail statistics were less favourable than in the previous year, there being increased mortality from tubercle of the lungs, pneumonia, dysentery, and diarrhœa. The Inspector-General does not consider the number of tubercle cases sufficient to warrant the cost of providing special wards. The increase of dysentery at Peshawar was ascribed to high winds bringing dust into the food.

Bombay.—The health statistics of the prisoners of the Bombay Presidency showed much improvement, while the total mortality ratio of the general population was raised by the ravages of plague. Overcrowding occurred in nine out of the 15 prisons, and was treated by transfer, and by the use of tents, temporary sheds, worksheds, &c. The use of worksheds for the purpose is an undesirable expedient. Cerebrospinal fever broke out in the Ahmedabad Central Prison, relapsing fever in the Deccan Gang, and 24 cases of plague were distributed over six prisons. In the Sind Gang the proportion of pneumonia deaths was, as usual, high ; and new barracks with improved ventilation have been built. Many of the men who developed pneumonia in the Hyderabad Central Prison had suffered previously from scurvy. The only case recorded as cholera occurred in the Thana Special Prison. The attack began with indigestion, and there was no cholera in the town and district at the time. Prophylactic measures in regard to diet and clothing were adopted, among them the issue of potatoes in lieu of green vegetables. The description of the prophylactic use of quinine in the Yerrowda Central Prison shows that the dose was too small and the interval between doses too long.

Berar.—In Berar, there was less bowel complaint, little cholera, and the general mortality, though higher than in 1901, was not high as compared with former years. The general health of the prisoners was satisfactory. The improvement at Akola was ascribed to diminution in the number of prisoners. The medical superintendent at Amraoti dreads the cost of the extensive use of quinine as a prophylactic ; but there is good evidence to show that the least wasteful method is to repeat doses of not less than 15 grains at suitable intervals for a period of about three months. In the end less quinine is used than when smaller doses are given unsystematically, and the general hospital expenses are lowered. Though there was plague in the station and district of Buldana, the jail escaped. All newly admitted men were kept under observation and in segregation for 10 days, all the prisoners and the establishment were inoculated, and the mouths and outlets of drains were so fixed as to prevent the ingress of rats. There was no cholera.

Central Provinces.—In the Central Provinces the year was considered to be a healthy one, there being little cholera, and diminished bowel disease, though the general mortality was somewhat increased. Among the prisoners, sickness was greater than in the previous year, but the mortality was nearly 3 per 1,000 less. The apparent increase in sickness seems to have been due, partly, if not wholly, not so much to increase of disease as to greater liberality in the admission of sick men to hospital. There does not seem to have been any serious overcrowding of the jails, but timely transfer might have made it even less. The construction of tubercle isolation wards is under consideration. Under the orders of the Government of India a special investigation was made into the sanitary conditions of the Jubbulpore Central Prison, and the circumstances which had conduced to the high mortality of 1901. As a result, structural improvements were sanctioned, a complete change was made in the diet, and prisoners were more freely admitted to the infirm gang. In the jails of the Central Provinces mortality from dysentery was still further reduced ; and there was no cholera.

Madras.—As cholera, fevers, and bowel complaints were less prevalent, the mortality of the population of the Madras Presidency diminished. For the prisoners, too, it was "an exceptionally favourable year," the general ratios of sickness and mortality being diminished, as well as the death-rates from cholera, tubercle of the lungs, pneumonia, and dysentery. In the case of those jails where mortality was high, the cause was stated to have been the poor health of the prisoners on admission. Cholera occurred in the Palamcottah jail only,* and there appeared to be no connection between the three cases. The disease was prevalent in the town and district at the time. The patients were removed,

* There was one case of "choleraic diarrhœa" at Madura.

their contacts were isolated, and the cells were thorough disinfected. Notwithstanding the prevalence of plague in the vicinity of several jails, only one prisoner was attacked. In the malarious Rajamundry jail, quinine prophylaxis was combined with the attempt to destroy the larvæ of anopheles mosquitoes in the vicinity of the jail. But the principle adopted by the medical officer of treating "trivial ephemeral cases" by detention and not by admission to hospital is bad, and has been condemned by authority. Tuberculous patients are treated separately, measures are taken for the thorough disinfection and destruction of their excreta, the open air treatment is as far as possible enforced, and plans are being considered for the provision of special wards.

Coorg, Rajputana, Baluchistan.—The health statistics of the Mercara jail showed considerable improvement, the mortality being less than a quarter of that of 1901. At Ajmer and at Quetta, though there was an increase of sickness, there was a considerable reduction in mortality. At Quetta, the ratios, both of sickness and mortality, compare very unfavourably with those of the quinquennium; the average numbers of prisoners in this jail is, however, only between 60 and 70.

The General Population.

Births in India.—In 1902 the total number of births recorded among the populations under registration in the British Provinces of India was 8,791,214, a number little short of the aggregate populations of Scotland and Ireland. The birth-rate in 1902 was 39·38 per 1,000, as compared with 34·60 in 1901. In every province except Lower Burma the birth-rate in 1902 was higher than in the preceding year; in most provinces the increase was considerable, and in two, Berar and Ajmer-Merwara, enormous. In every province except three the number of recorded births exceeded the deaths, the excess ranging from 24·1 per 1,000 of population in Berar and 22·46 in the Central Provinces, to 5·20 in Assam and 3·22 in Ajmer-Merwara. In the Punjab, where the death-rate from plague alone was 8·52 per 1,000, the death-rate was 0·3 per 1,000 higher than the birth-rate, and in Bombay, where the plague death-rate was 10 per 1,000, the death-rate exceeded the birth-rate by 4·88 per 1,000. In the small province of Coorg the death-rate was 3·14 higher than the birth-rate, not because deaths were excessively numerous but because the number of births recorded was small.

The percentages of male to female births ranged from 100·77 in Coorg and 104·1 in Madras, to 121·9 in the North-West Frontier Province and 126·84 in Sind, the percentage in each province being fairly characteristic of the province; but it is noteworthy that in a year of high birth-rates in every province except Sind and the North-West Frontier Province, in the latter of which the percentage was the same as the mean of the ten years 1891–1900, the percentage excess of males was below the average.

Deaths in India.—The number of deaths recorded was 7,112,336, a number nearly equal to the populations of Sweden and Norway. The death-rate was 31·49 per 1,000, as compared with 29·46 in 1901. In all provinces except Madras, Burma, Coorg, and Ajmer-Merwara, the death-rates in 1902 were higher than in the preceding year, and in every province except Assam, where the towns are merely large villages, the urban were higher than the rural death rates.

The smallest number of deaths recorded in any one month was 468,898 in July, in which month the minima were recorded in the United Provinces, the Punjab, the North-West Frontier Province, the Central Provinces, and Ajmer-Merwara; while the largest number was 755,824, recorded in December, the month in which the maxima were recorded in Bengal and Bombay.

In the United Provinces, the Punjab, the North-West Frontier Province, Coorg, Bombay, and Ajmer-Merwara, the death-rates of females were higher than the death-rates of males; but only in the Punjab was the excess of mortality among females considerable.

The death-rates in the various provinces by ages show that infantile mortality is in some cases exceedingly large. This is due to the fact that the ratio is calculated upon the census population, and it is obvious if, at the time of the census, the population of infants in any province was low, a year in which the birth-rate is high will be marked by a high ratio of deaths with reference to the census population. Thus,

to take an extreme instance, in 1900, the year before the census was taken, the number of births recorded in Berar was 89,302, while in 1902 the number was 154,954; in 1902 the death-rate of infants, calculated on the census figure, was 620·1 per 1,000 among males and 523·3 among females; whereas the corresponding figures, calculated upon the numbers born during the year, were 203·8 and 182·9.

Birth and Death Statistics.

Province.		Births.			Number of Deaths.			Ratio of Deaths per 1,000 of Population.			Mean Death-Rate during previous 5 years.			Number of deaths of males to every 100 deaths of females.
		Total number.	Ratio per 1,000 of population.	Mean ratio per 1,000 of population during previous five years.	In Municipalities and towns.	In Districts, exclusive towns.	Total.	In Municipalities and towns.	In Districts, exclusive towns.	Total.	In Municipalities and towns.	In Districts, exclusive towns.	Total.	
Bengal	1901	2,870,806	38·57	36·74	136,260	2,174,164	2,310,424	37·12	30·72	31·04	32·99	30·73	30·85	110·
	1902	2,987,800	40·14	37·19	133,416	2,355,012	2,488,428	35·98	33·30	33·43	33·31	30·38	30·53	112·
Assam	1901	179,289	33·98	31·77	3,206	143,733	146,939	29·74	27·81	27·85	42·56	35·04	35·19	111·62
	1902	180,475	34·21	32·21	3,075	149,995	153,070	28·52	29·03	29·01	40·58	33·58	33·90	109·77
United Provinces of Agra and Oudh.	1901	1,972,131	41·35	38·45	144,979	1,300,056	1,445,035	29·34	42·87	30·30	40·60	32·52	33·09	108·79
	1902	2,186,201	45·84	39·65	157,903	1,394,143	1,552,046	46·69	31·46	32·54	41·12	31·83	32·48	106·66
Punjab	1901	712,553	35·4	41·1	75,188	651,423	726,611	37·71	35·98	36·13	35·65	32·04	32·40	105·2
	1902	880,477	43·8	40·0	98,481	788,492	886,973	49·39	43·53	44·11	36·72	33·38	33·71	100·0
North-West Frontier Province.	1901	60,413	29·5	37·1	3,768	35,440	39,208	18·28	19·26	19·16	33·73	30·82	30·40	113·3
	1902	66,904	33·6	39·7	4,528	44,096	48,624	27·57	24·14	24·43	28·14	24·12	23·7	111·0
Central Provinces.	1901	279,998	28·83	*	22,290	205,563	227,853	28·49	23·02	23·46	50·32	*	*	111·92
	1902	471,774	48·29	*	25,926	226,353	252,279	32·42	25·23	25·82	42·47	*	*	110·30
Berar	1901	83,762	30·8	38·2	12,329	62,751	75,080	29·6	27·2	27·6	51·4	48·1	48·5	104·4
	1902	154,954	56·9	38·2	15,213	73,940	89,153	36·6	32·0	32·8	*	*	46·7	107·0
Madras Presidency.	1901	935,749	25·1	29·8	94,710	701,430	796,140	32·7	20·4	21·3	30·5	21·4	22·1	105·1
	1902	1,023,146	28·2	28·9	101,399	631,038	732,437	28·2	19·3	20·2	31·2	21·5	22·2	104·0
Coorg	1901	3,401	18·83	22·0	811	5,779	6,590	53·18	34·95	36·49	45·67	31·85	33·02	127·24
	1902	4,319	23·91	20·67	563	4,324	4,887	36·92	26·15	27·06	43·27	33·92	39·12	122·74
Bombay Presidency.	1901	465,647	25·19	32·89	139,794	546,340	686,134	57·85	34·01	37·12	61·65	38·45	41·30	108·
	1902	631,393	34·16	30·57	145,524	575,938	721,462	60·22	35·85	39·04	65·77	39·08	42·40	104·
Lower Burma ..	1901	177,865	32·07	34·72	19,919	100,646	120,565	29·99	20·62	21·74	32·19	25·26	26·17	129·
	1902	175,106	31·57	34·68	19,882	97,504	117,386	29·93	19·97	21·16	32·52	24·80	25·79	128·
Upper Burma ..	1901†	11,334	37·66	—	10,010	—	10,010	33·27	—	33·27	—	—	—	111·
	1902‡	11,458	38·0	*	9,014	40,905	49,919	29·95	15·82	17·30	*	*	*	98·
Ajmer-Merwara	1901	7,679	16·10	32·36	5,064	10,734	15,798	36·06	30·91	33·13	59·55	49·01	51·91	111·29
	1902	17,207	36·08	28·13	5,296	10,376	15,672	40·85	29·88	32·86	68·99	48·69	52·11	110·19

* Not available. † Statistics for 13 towns. ‡ Statistics of births for 13 towns only.

In the following paragraphs will be found the principal details of registration in the different provinces.

Bengal.—In 1902 the number of births registered in the 720 registering circles in Bengal was 2,987,800, or 116,994 more than in the previous year, and the birth-rate was 40·14 per 1,000, as compared with 38·57, and a quinquennial average of 37·19. In 26 of the 46 districts the birth-rate was over 40 per 1,000, the highest rates being 53·10 in Noakhali, 49·36 in Dinajpur, and 47·28 in Malda; in four districts the birth-rates were below 31 per 1,000—Midnapore 30·84, Pabna 30·16, Hooghly 30·07, and Calcutta 14·29. Calcutta is, of course, an urban district, but the birth-rate is little more than half the average of the other Bengal towns—28·11. Including Calcutta, the birth-rate in the towns of Bengal was 24·95 per 1,000, against 40·93 in rural areas. In certain of the smaller towns, however, very high birth-rates were recorded, notably in Jamalpur 74·52, Tikari 59·34, Sahibganj 57·81, Monghyr 55·85, and Revelganj 50·79. The average percentage of male to female births was 105, ranging from 102 in six districts to 109 in Howrah and Hooghly, 110 in Calcutta, 111 in Pabna, and 112 in Darjeeling, all districts in which the recorded birth-rates were very low.

The number of deaths recorded in 1902 was 2,488,428, or 178,004 in excess of the total of 1901. The death-rate was 33·43 per 1,000, as compared with 31·04 in 1901, and

30·53 the average of the previous five years. By far the highest district death-rate was 50·09 registered in Nadia; this was followed by rates of 43·35 and 42·54 in Faridpur and Jessore respectively. The three lowest district rates were recorded in Ranchi 25·22, Tippera 23·15, and Sonthal Parganas 21·02. The average death-rate in the towns was 35·98, or 2·68 per 1,000 higher than the average in rural areas. In 18 towns, including Hooghly and Chinsura (56·05) and Pabna (55·67), the death-rates were over 50 per 1,000, the highest rates being 105·72 recorded in Barh, a town of 12,000 inhabitants in the Patna district, 65·23 in Revelganj, a small town in Saran, and 64·13 in Chapra, a town of about 46,000 inhabitants, also in Saran. In most of the towns where the death-rate was excessive plague was present.

The death-rates among infants were 301·80 and 254·05 per 1,000 living of males and females respectively; among children between one year and five years of age the rates were 50·67 among males and 44·28 among females. At all age periods the male death-rates were the higher, the average death-rates being 35·36 and 31·50 among males and females respectively.

Among the various sects the lowest death-rate was registered among Christians (19·36), followed by 21·14 among Buddhists and 28·27 among other classes. Hindus and Muhammadans died at the rates of 33·40 and 34·0 respectively.

The number of European seamen who arrived in the Port of Calcutta was 20,146, the daily average population in the Port being 1,154. The number of deaths reported was 23, including 13 from cholera, equal to a total death-rate of 19·93, as compared with 16·52 in 1901. The estimated floating native population of the Port was 25,630, among whom 138 deaths, including 63 from cholera, were reported, equal to a total death-rate of 5·37, against 5·34 in 1901.

Assam.—The number of births registered in Assam in 1902 was 180,475, as compared with 179,289 in the preceding year, and the birth-rate was 34·21, against 33·98 in 1901, and the quinquennial mean of 32·21. The highest district birth-rate was, as usual, recorded in Goalpara (45·23 per 1,000), and following this were birth-rates of 37·15 and 35·58 in Sylhet and Cachar respectively; the lowest rate was 24·46 in Sibsagar. The percentage of male to female births ranged from 112·24 in Nowgong to 101·68 in Cachar, the mean being 106·66.

The recorded deaths numbered 153,070, or 6,131 more than in 1901, and the death-rate was 29·01, against 27·85 in the previous year, and 33·90 the mean of the previous five years. In the districts the death-rates ranged from 35·72 in Darrang to 18·14 in Sibsagar. In the towns the mean death-rate was 28·52, against 29·03 in rural areas; and in the towns the recorded rates varied much more than in rural areas, from 46·73 in North Lakhimpur to 15·86 in Sunamganj. It may be noted that the most populous of the 19 towns in Assam contains only 13,893 inhabitants, and only three others contain over 10,000. Among Christians the death-rate was 14·13, among Hindus 23·77, among Muhammadans 34·93, and among other classes 44·79. Male infants died at the rate of 198·53 per 1,000 living at the time of the census, and female infants at the rate of 179·61. Children over one year of age and under five died at the rates of 35·75 and 35·24 per 1,000 among males and females respectively. At all age periods, save 15–20 and 20–30, the male death-rates were the higher, the means being 29·46 among males and 28·54 among females.

Assam tea gardens.—The mean annual strength of the labour force in Assam in the twelve months ending the 30th June, 1903, was 644,045, of which total 60·23 per cent. were employed in the Assam Valley and 39·77 in the Surma Valley. The birth-rate was 30·8 per 1,000 of the total number, and 98·6 per 1,000 adult females, a slightly lower figure than the birth-rate calculated on the number of births registered per 1,000 adult females in the general population.

The total number of deaths among the coolies was 16,376, including 1,024 from cholera, 1,571 from diarrhœa, 2,516 from dysentery, 2,612 from malarial fever, 2,150 from anchylostomiasis, and 1,928 from respiratory diseases.

The number of gardens, which was 812 at the beginning of the year, fell to 788 before its close, and among them 11 only were classed as unhealthy, that is, showed a a death-rate of 70 per 1,000 or over.

The number of deaths among all classes of immigrants during their transit between the port of embarkation and their destination in the Assam Valley was 57, including 42 from cholera. Among the immigrants to the Surma Valley there was no death on the railway, and only one among the coolies who travelled by steamer.

United Provinces of Agra and Oudh.—The number of births recorded in the United Provinces reached a total of 2,186,201, or 214,070 more than in 1901, and the birth-rate was 45·84 per 1,000, against 41·35 in the previous year, and 39·65 the mean of the previous five years. Among the districts the three highest birth-rates were recorded in Hamirpur, 56·74 ; Shahjahanpur, 55·84 ; Pilibhit, 54·97 ; and the three lowest in Ballia, 37·28 ; Naini Tal, 35·11, and Dehra Dun, 30·04. The mean birth-rate of the towns was 43·35, ranging from 63·03 per 1,000 in Ujhani, to 23·79 in Mirzapur-Bindachal, 21·21 in Naini Tal, and 14·0 in Mussoorie. The percentage of males born to females born was 117·64 in Dehra Dun, and in the other districts it varied between 110·70 in Muttra and 101·98 in Garhwal, the average for the province being 107·25.

The deaths registered during 1902 numbered 1,552,046, as compared with 1,445,035 in the preceding year, and the death-rate was 32·54 per 1,000, against 30·30 in 1901, and the quinquennial mean of 32·48. The highest district death-rates were 49·50 in Cawnpore, 43·78 in Naini Tal, and 43·06 in Meerut, while the lowest were 23·80, 24·33, and 24·60 in Azamgarh, Gorakhpur, and Almora respectively. In rural areas the average death-rate was 31·46, while in the towns the average was 46·69, ranging from 104·94 in Cawnpore and 78·60 in Jaunpore, to 23·32 in Balrampur and 18·29 in Basti. The lowest death-rate in the year was recorded in July, the highest death-rates in October and November.

Christians are reported to have died at the rate of 10·36, and "other classes" at the rate of 13·92. The Muhammadan death-rate was 33·27, and the Hindu 32·55.

The death-rate of infants was very high, 374·97 and 348·53 among males and females respectively. Boys and girls over one and under five died at nearly the same rates, 59·01 and 59·49 respectively. In the age periods, 10–15, 15–20, 20–30, the female rates were higher than the male rates, the average death-rates of the sexes being almost identical—32·54 and 32·55.

Punjab.—In 1902 there were 880,477 births registered in the Punjab, against 712,533 in the previous year, and the birth-rate was 43·8 per 1,000, as compared with 35·4 in 1901, and the quinquennial mean of 40·0. In ten of the districts the birth-rate was over 45 per 1,000, the highest rate being 54·4 in Sialkot, 52·1 in Gujrat, and 49·0 in Gurdaspur ; and in only two districts were the rates below 35, namely, Dera Ghazi Khan (34·9) and Simla (19·1). The percentage of male and female births was 110·4 ; in Dera Ghazi Khan the percentage was 120·2 ; in the other districts it varied between 115·2 in Simla, 115·0 in Mianwali, and 105·5 in Ludhiana.

The number of deaths recorded was 886,973, or 160,362 more than in 1901, and the death-rate rose from 36·1 per 1,000 in the preceding year to 44·1, which is 10·4 per 1,000 higher than the quinquennial mean. In some of the plague-stricken districts the rates were very high, notably in Ludhiana 103·9, Sialkot 66·7, Umballa 66·6, Jullundur 54·8, and Gurdaspur 51·0 ; in others from which plague was absent, the death-rates were low, *e.g.*, Dera Ghazi Khan 24·2, Montgomery 23·4, and Simla 21·3. In rural areas the average death-rate was 43·53 per 1,000, against 49·39 in the towns. Among the latter, death-rates of over 100 per 1,000 were recorded in six, namely, Khanna 177·44, Jagraon 152·99, Raikot 136·81, and Machiwara 132·61, all in Ludhiana, Jamke in Sialkot 142·79, and Rupar in Umballa 111·61. In all cases the excess death-rate was due to plague. In a few towns the recorded death-rates were very low, the lowest being 18·93 in Kot Mithan, 17·49 in Leiah, and 15·75 in Montgomery. The monthly death-rates were at their highest in March 5·64, and April 5·52, and at their lowest in June 2·47, July 2·07, August 2·39, and September 2·56.

Among the sects by far the lowest death-rate was recorded among Christians, 23·74 per 1,000, and the highest among "other classes," 50·29. Muhammadans and Hindus died at the rates of 41·88 and 46·75, respectively.

Male infants died at the rate of 316·44 per 1,000 living, and females at the rate of 320·76. Children over one year and under five years of age died at the rates of 62·16 and 65·93 among males and females, respectively. In all age periods the female death-rates were the higher, the average death-rate of males being 41·1, and of females 47·6 per 1,000.

North-West Frontier Province.—The number of registered births in the North-West Frontier Province was 66,904, or 6,491 more than in 1901, and the birth-rate was 33·6 per 1000, as compared with 29·5 in the previous year, and an average of 30·7 recorded in the previous five years in the districts of which the province is made up. The highest district rate was 37·7 in Dera Ismail Khan, and the lowest 31·8 recorded in two districts, Hazara and Peshawar. The average percentage of male to female births was 121·9.

There were 48,624 deaths registered against 39,208 in 1901, and the death-rate was 24·4 per 1,000 as compared with 19·2 in the previous year, and a quinquennial mean of 23·7. Although the death-rates in the districts varied much, from 33·3 in Kohat to 20·7 in Hazara, no rate was very high, and there were only four deaths from plague during the year. The rural death-rate was 24·14 against 27·57 in the towns, among which the rates ranged from 35·18 in Dera Ismail Khan, to 17·97 in Abbottabad.

Muhammadans and Hindus died at the rates of 24·92 and 21·67, respectively ; and the death-rates of Christians and other classes are given as 4·14 and 2·51.

Male infants died at the rate of 180·22 and female infants at the rate of 145·00 per 1,000 living, respectively. Children between the ages of one year and five years died at the rates of 43·59 and 42·87 per 1,000, respectively. The female death-rate was higher than the male in every age period except 0–1, 1–5, and 50–60.

Central Provinces.—The number of births registered in the Central Provinces, including zamindaries, in 1902 was 471,774, or 191,776 more than in 1901, and the birth-rate reached the high figure of 48·29 per 1,000 as compared with 28·83 in the preceding year. The highest birth-rate, 76·34 per 1,000, was reported from the Bilaspur zamindaries and the lowest 38·56 from the British territory in the same district, a contrast with which redistribution of the population after the famine, during which the census was taken, has probably much to do. In the other districts the rates ranged from 59·89 per 1,000 in Wardha and 58·51 in Nimar, to 40·04 in Raipur and 40·14 in Sambalpur. The percentages of male to female births varied from 107·77 in Nagpur, to 100·68 in Murwara, the mean percentage being 104·78.

The deaths numbered 252,279 against 227,853 in 1901, and the death-rate was 25·82 against 23·46. In no district was the death-rate excessive, and in some the rates were very low, the extremes being 38·95 in Burhanpur (plague 7·95) and 18·99 in Bilaspur (*khalsa*). The rural death-rate was 25·23 against 32·42 in the towns, in a few of which plague occurred, notably, Burhanpur, total death-rate 55·67 (plague death-rate 19·37), and Jubbulpore, total death-rate 44·79, including 2·87 from plague. In the other towns the rates ranged from 42·13 in Kalmeshwar, in Nagpur, and 12·52 in Mandla.

The death-rate of Muhammadans was 32·18 per 1,000, of Hindus 22·70, and of " other classes" 43·21.

The death-rate of infants, calculated upon the census population of infants, was 492·91 among males and 431·12 among females, but calculated on the numbers of births registered during the year the rates were 224·14 among males and 201·95 among females. Boys between the ages of one year and five died at the rate of 32·84, and girls at the rate of 29·23 per 1,000. At all periods, save 15–20, the male death-rates were the higher the average death-rate among males being 27·55, and among females 24·15.

Berar.—A combination of favouring circumstances resulted in the birth-rate being the highest ever recorded in Berar ; 154,954 births were registered against 83,762 in 1901, and the birth-rate was 56·9 per 1,000 against 30·8 in the previous year, and 38·2 the mean of the previous five years. In every district the rates were very high, ranging from 62·7 in Buldana to 53·2 in Amraoti. The rural birth-rate was 58·3 per 1,000 against 49·1 in the towns. The mean percentage of male to female births was 104·7, varying between 108·1 in Ellichpur, and 102·3 in Wun.

The recorded deaths numbered 89,153, or 14,073 more than in 1901, and the death-rate was 32·8 per 1,000, as compared with 27·6 in the previous year, and the quinquennial mean of 46·7. The district death-rates varied considerably, Buldana 41·0, and Basim 28·7, furnishing the extremes. In rural areas the death-rate was 32·0 per 1000 against 36·6 the average in the towns. In a few of the latter the death-rates were very high, Khamgaon in Akola 99·3 per 1,000, of which 64·3 per 1,000 was due to plague, Shegoon in the same district, 53.6, of which 22·9 was due to plague, and Chikhli in Buldana 48·2, of which 11·5 was due to plague, being the most conspicuous. In only five towns were rates below 25 per 1,000 registered, namely, Ner Pinglai 24·8, Mangrul Dastagir 24·7, Wun 24·4, Pusad 24·0, and Talegaon 23·9.

Among Muhammadans and Hindus the death-rates were, respectively, 32·2 and 32·7, and among Christians and other classes 14·6 and 37·0.

Owing to the small population of infants at the time of the census and the enormous birth-rate of the year, the infantile death-rates computed upon the census figures were very high, 620·1 and 523·3 for male and female infants, respectively ; but computed upon the number of births recorded during the year those death-rates were only 203·8 and 182·9. The death-rate of boys over one year of age and under five was 62·5, and of girls

56·2. In the age periods, 10–15, 15–20, 20–30, and 30–40, the female death-rates were the higher, the average for the sexes being 33·5 and 32·1 among males and females respectively.

Madras.—In 1902 the number of births registered in Madras was 1,023,146, as compared with 935,749 in the preceding year. In 1902 the birth-rate was 28·2 per 1,000, against 25·1 in the previous year, and 28·9, the average of the previous five years. In the districts the birth-rates ranged from 34·9 in Madras town district and 33·6 in Tinnevelly, to 22·8 in Ganjam and 22·4 in North Arcot. In rural areas the average birth-rate was 28·1, or 1·1 per 1,000 less than in the towns. The mean percentage of male to female births was 104·1, ranging from 110·0 in the Nilgiris, 108·6 in Ganjam, and 105·5 in North Arcot and Tanjore, to 100·0 in Nellore. In the towns the mean percentage was 105·7.

The recorded deaths numbered 732,437, or 63,703 fewer than in 1901, and the birth-rate was 20·2 per 1,000, as compared with 21·3 in the previous year, and 22·2 the mean of the previous five years. By far the highest death-rate was registered in the Madras town district, where the people died at the rate of 42·4 per 1,000. After Madras came Bellary, with a death-rate of 32·6. Among the other districts death-rates varied between 26·3 in the Nilgiris, and 15·1 in Vizagapatam and 11·9 in Ganjam. In rural areas the mean death-rate was 19·3, or 8·9 less than the mean rate in the towns, which was 28·2. In Vaniyambadi, a town of about 12,000 inhabitants, in the Salem district, the death-rate was 128·9, including rates of 80·1 from plague, 3·7 from cholera, and 2·7 from small-pox. In Adoni, in the Bellary district, the death-rate was 56·5, including 28·9 from plague and 6·3 from cholera. In Hospet, also in Bellary, the death-rate was 48·9, including 34·1 from plague and 1·0 from cholera. In Bellary the death-rate was 48·0, including 24·0 from plague and 1·2 from cholera. In the remaining towns the rates ranged from 42·0 in Yemmiganuru to 5·1 in Vempalli, a town of about 10,800 inhabitants in Cuddapah, and 3·4 in Nellikuppam, in South Arcot.

While Muhammadans died at the rate of 21·2 per 1,000, Hindus at the rate of 20·4, and Christians at the rate of 18·1, the registered death-rate among 1,559 included among "other classes" was only 3·9.

The death-rate among male infants was 169·0 per 1,000 living at the time of the census, against 140·9 per 1,000 among female infants. Boys and girls over one year and under five years of age died at the rates of 28·1 and 26·5 respectively. At the age period 10–15, the death-rates of the sexes were equal; at all age periods, except 15–20 and 20–30, the male death-rates were the higher, the mean rates being 20·8 among males and 19·5 among females.

Coorg.—In the small province of Coorg, in 1902, there were registered 4,319 births, equal to a birth-rate of 23·91 per 1,000, against 18·83 in 1901 and a quinquennial mean of 20·67. In the districts the rate ranged from 31·20 in Padinalknad to 17·76 in Yedinalknad. The percentage of males born to females was 100·98.

The number of deaths recorded was 4,887, and the death-rate fell from the quinquennial mean of 35·25 per 1,000 and 36·49 in 1901 to 27·06 in 1902. The highest district death-rate was 29·80 in Nanjarajapatna Taluk, and the lowest 24·16 in Yedinalknad, the urban rate being 36·92 against 26·15 in the country.

The death-rate of male infants was 167·99 per 1,000, and of females 151·53. At the age periods, 10–15, 15–20, 20–30, 30–40, and 60 and over, the female death-rates were the higher, and the mean death-rates of the sexes were 26·87 among males and 27·31 among females.

Bombay.—In Bombay, in 1901 the number of births recorded was only 465,647, equal to a birth-rate of 25·19 per 1,000; but in 1902 there was a great increase, the number of births rising to 631,393 and the birth-rate to 34·16, which is 3·59 per 1,000 in excess of the quinquennial mean.

Khandesh heads the list of districts with the high birth-rate of 52·93 per 1,000, and this, it may be noted, in spite of the prevalence of plague, which caused a death-rate of 17·58 per 1,000. The next highest birth-rates were 44·67 and 44·46, in Ahmednagar and Panch Mahals, respectively. As usual, the lowest birth-rates were recorded in the Sind districts, Thar and Parkar, with a birth-rate of 16·54, being the lowest. In the country the mean birth-rate was 35·23, against 27·09 in the towns. The mean percentage of male to female births in the whole presidency was 107·80; but in Bombay proper the percentages varied between 109·40 in Ahmedabad and 100·27 in Bijapur; whereas in Sind the percentages ranged from 136·64 in Hyderabad to 116·78 in Karachi.

The number of deaths recorded in 1902 was 721,462, or 35,328 more than in the previous year, and the death-rate was 39·04 per 1,000, against 37·12 in 1901 and a quinquennial mean of 42·40. Excluding the town district of Bombay City, in which the death-rate was 63·13, the highest death-rates were 58·29 and 58·07, recorded respectively in Kaira and Dharwar, and the lowest were 20·22 in Sukkur, 18·77 in Ratnagiri, and 17·66 in Upper Sind Frontier. In rural areas the mean death-rate was 35·85, but in the towns, many of which suffered terribly from plague, the mean was 60·22, ranging in individual towns from 185·22 in Yeola, in Nasik, and 153·14 in Gokak, in Belgaum, to 15·04 in Vengurla, in Ratnagiri, 14·34 in Ahmedabad cantonment, and 10·61 in Ahmednagar cantonment.

Hindus died at the rate of 41·68, Muhammadans and Parsis at the rates of 30·04 and 27·30 respectively, and Christians and "other classes" at the rates of 25·31 and 23·98.

The death-rates of infants, calculated upon the census population, were 318·47 and 286·11 per 1,000, and of boys and girls over one year and under five years of age, 44·79 and 43·90 respectively. Although at all age periods except 5–10, 10–15, and 15–20 the male death-rates were the higher, the mean death-rate of males was 38·77 per 1,000 against 39·32 per 1,000 among females.

Lower Burma.—The number of births recorded in Lower Burma in 1902 was 175,106, or 2,759 less than in 1901, the slight decrease being probably due to a relaxation of energy in the supervision of the inspection of registers. The birth-rate was 31·57, or 0·5 per 1,000 less than in 1901, and about 3 per 1,000 less than the quinquennial mean, which, however, is calculated in respect of four years on a population about 21 per cent. smaller than that on which the rates for 1902 are calculated. Among the district rates over 40 per 1,000 were registered in Tharrawaddy (40·80) and Sandoway (40·09), the remainder ranging from 38·53 in Henzada to 23·04 in Toungoo and 14·11 in the Rangoon Town district. The rural birth-rate was 32·52, as compared with a mean of 24·46 in the towns, in which, with two exceptions, the birth-rates varied between 42·91 in Allanmyo and 17·32 in Akyab. The exceptions were the little town of Zigon, in which the highest birth-rate (89·73) of 1902 was registered and the town of Rangoon, in which again the lowest birth-rate is recorded. The percentage of males to female births was 107, but the variation in the districts was considerable, from 111 in Pegu to 103 in Henzada, and 102 in Rangoon Town district.

The recorded deaths aggregated 117,386 against 120,565 in 1901, and the death-rate was 21·16 per 1,000 against 21·74 in 1901, and a quinquennial average of 25·79. By far the highest district death-rate was 33·57 registered in Rangoon town, and this is followed by a rate of 26·13 in Sandoway; in the remaining districts the death-rates varied from 23·86 in Pegu to 15·21 in Mergui. The rural death-rate was 19·97, nearly 10 per 1,000 lower than the mean urban rate which was 29·93, ranging from 54·51 in Zigon and 43·86 in Kyaiklat to 20·70 in Tavoy and 10·93 in Mergui.

Christians and Muhammadans died at the rates of 12·13 and 16·40 per 1000; Buddhists and "others" at the rates of 21·59 and 19·42; and Hindus died at the rate of 24·16.

Male infants died at the rate of 307·47 per 1,000 living at the time of the census, and females at the rate of 221·89. Boys and girls between the ages of one year and five years died at the rates of 26·13 and 22·46, respectively. At all age periods the male death-rates were the higher, the mean death-rate of males being 22·37 and of females 19·81.

Upper Burma.—In 13 towns in Upper Burma both births and deaths are registered, and in the districts, of which, however, the population figures are not available, deaths are registered.

The mean birth-rate in the towns was 38·0 per 1,000, the rates ranging from 57·01 in Kyaukse to 20·42 in Minbu; and the mean death-rate was 29·95, the same towns, Kyaukse (43·73) and Minbu (14·19), furnishing the extremes.

Ajmer-Merwara.—The number of births recorded in Ajmer-Merwara in 1901 was only 7,679, but in 1902 the number rose to 17,207, equal to a birth-rate of 36·08 per 1,000 against 16·10 in 1901, and a quinquennial mean of 28·13. The percentage of male to female births was 115·25 as compared with 119·15 in 1901 and 123·79 in 1900.

The deaths in 1901 numbered 15,798, and in contrast to the vast increase in the number of births, the number of deaths in 1902 fell to 15,672, equal to a death-rate of 32·86 as compared with 33·13 in 1901, and a quinquennial mean of 52·11. The rural death-rate was 29·88, while the mean death-rate in the towns was 40·85.

Hindus and Muhammadans died at the rate of 35·05 and 31·49 per 1,000, respectively.

Male and female infants died at the rates of 219·15 and 214·41 per 1,000 registered births. In the age periods 15-20, 20-30, and 30-40, the female death-rates were the higher, the mean death-rates of the sexes at all age periods were 32·73 among males and 33·01 among females.

History of the Chief Diseases.

Cholera.

The number of deaths from cholera recorded in British territory during 1902 was 224,136, equal to a death-rate of 1·01 per 1,000 of the total population under registration. If the deaths recorded in the native states from which returns were received be added, the total amounts to 225,885. In the previous year 271,210 deaths from cholera were recorded in British territory, giving a ratio of 1·21 per 1,000 of population, so that during the year under review a considerable reduction in the mortality from this disease occurred; and, as compared with 1900, when no less than 797,222 deaths from cholera were recorded in the British provinces alone, the decrease during 1902 was very great. Although the disease was, on the whole, more prevalent during the first half of the year than the second, the month of least prevalence during the whole year was February. From April, which was the month of maximum prevalence, a steady fall in the number of deaths recorded each month occurred until the end of October, the mortality again increasing in November and December. The disease was most prevalent during the year in Assam, Bengal, and Madras; but in all the provinces except Bengal, Assam, and the Punjab, the mortality was less than in the previous year. The North-West Frontier Province and Coorg were quite free from cholera, and the Central Provinces nearly so.

Deaths from Cholera in the different Provinces in India from 1877 *to* 1902.

YEAR.	Bengal.*	Assam.	United Provinces of Agra and Oudh.	Punjab.	(a) N.-W. Frontier Province.	Central Provinces.	Berar.	Madras.	Coorg.	Bombay.	Lower Burma.	Upper Burma†	Ajmer-Merwara.	Rajputana.	Central India.	Hyderabad. (Cantonments stations).	Mysore.
1877 ..	155,305	11,377	31,770	29	—	3,418	842	357,430	‡	57,228	7,276	—	11	60	926	7,414	2,902
1878 ..	95,192	6,732	22,221	215	—	40,985	34,306	47,167	49	46,743	6,759	—	210	2,393	8,047	6,696	723
1879 ..	130,363	17,415	35,892	26,135	—	27,575	223	13,296	—	6,937	1,828	—	120	918	2,734	6	14
1880 ..	39,643	2,083	71,546	274	—	330	1	613	—	684	2,638	—	3	—	299	—	25
1881 ..	79,180	5,010	25,865	5,207	—	9,140	3,404	9,446	3	16,694	5,239	—	16	197	581	1,721	25
1882 ..	182,352	21,055	89,372	39	—	11,932	3,573	23,604	31	7,904	7,177	—	289	1,327	1,562	150	893
1883 ..	90,439	14,908	18,160	190	—	16,235	27,897	36,284	—	37,954	2,185	—	87	797	1,740	1,947	124
1884 ..	134,421	22,276	30,143	614	—	149	87	75,476	—	13,804	5,515	—	227	1,297	1,018	2,479	330
1885 ..	173,767	7,753	63,457	1,936	—	21,868	3,683	58,109	—	37,287	7,685	—	100	1,615	4,624	1,387	2,677
1886 ..	118,368	20,188	34,565	12	—	16,679	976	12,417	—	167	4,027	—	765	173	290	499	10
1887 ..	172,578	7,941	200,628	8,804	—	12,576	14,396	28,359	3	25,711	2,649	—	384	2,612	8,868	2,831	832
1888 ..	111,391	9,693	18,704	14,938	—	921	305	58,677	2	36,500	15,982	—	13	32	191	2,057	1,015
1889 ..	171,103	18,288	48,494	2,838	—	52,588	10,925	76,020	9	32,431	3,240	—	55	6,923	3,344	1,128	1,590
1890 ..	145,885	15,396	80,295	3,401	—	4,787	847	35,288	5	3,259	1,076	—	408	2,746	3,132	—	1,326
1891 ..	229,575	23,882	169,013	10,107	—	21,312	7,958	98,773	7	17,850	2,400	—	532	2,946	13,474	3,102	1,204
1892 ..	259,398	21,552	194,886	75,959	—	39,972	2,030	79,033	58	42,900	6,208	—	2,352	26,760	8,384	53	5,497
1893 ..	126,976	21,849	12,154	639	—	557	1,188	32,209	9	18,853	2,393	—	3	314	127	165	680
1894 ..	236,150	13,497	178,079	113	—	7,043	3,452	42,289	8	33,588	7,428	—	—	2	5,210	1,862	328
1895 ..	177,087	18,962	51,562	549	—	15,506	11,919	21,172	—	8,890	5,150	—	289	1,049	6,043	467	2,334
1896 ..	226,824	17,042	69,147	5,146	—	52,985	12,264	47,847	49	35,404	2,959	—	12	3,797	15,766	525	2,100
1897 ..	196,247	33,240	44,208	622	—	57,131	10,122	143,445	106	57,109	8,538	—	19	1,496	13,202	1,039	4,248
1898 ..	65,020	11,149	2,508	33§	—	7	—	65,444	8	4,368	2,972	—	1	6	2	6	1,193
1899 ..	107,678	8,380	8,142	1,816	—	76‖	541	29,082	—	8,579	4,942	2,050	1	498	—	—	123
1900 ..	345,878	23,761	84,960	28,260	—	63,114	18,375	60,662	—	163,889	3,440	41	4,842	28,719	20,450	3,813	779
1901 ..	110,753	7,468	53,995	180	117	49	17	81,370	58	13,600	3,552	‡	50	6	72	1	11,351
1902 ..	150,971	12,658	25,160	371	—	28	16	29,769	—	3,230	1,844	57	32	1,519	12	—	218

* Excluding Calcutta from 1877 to 1892.
† Statistics from 1877 to 1898 not available.
‡ Statistics not available.
§ Including 30 deaths in Cantonments.
‖ Excluding Zamindaries.
(a) Separated from the Punjab in 1901.

Assam.—The number of deaths attributed to cholera in Assam during 1902 was 12,658, a ratio per 1,000 of 2·40 of the last census population, and the highest ratio among the provinces for the year. In the previous year 7,468 deaths were recorded from cholera in this province, so that the increased prevalence of the disease during the year under review was considerable ; though the number of deaths and the death ratio were still considerably below the average figures for the past 16 years. The chief outbreak occurred in the Sylhet district, where there were recorded 8,804 deaths from this disease as compared with 2,805 in 1901. The Goalpara, Darrang, and Nowgong districts, which were so severely visited in 1900, were again, as in 1901, comparatively free from cholera in 1902 ; in the Nowgong district, where the death-rate in 1900 was 24·95 per 1,000, the death-rate in 1902 was only ·08 per 1,000. A severe outbreak occurred in the Sunamganj and Habiganj subdivisions in September, and lasted until the end of December. A similar outbreak had occurred in these subdivisions in 1900. Except in the Sylhet district, the rates in tea gardens were everywhere higher than the registered general rates. In the Surma valley, however, out of a labour population of 273,939 the number of deaths recorded was 467, giving a ratio of 1·70 per 1,000 as compared with a ratio of 3·86 in the remainder of the valley. In the Brahmaputra valley the rates for tea gardens and for the rest of the valley were 1·89 and 1·01 per 1,000, respectively.

The number of tea-garden cooly immigrants increased slightly as compared with the previous year, but the death-rate among them while in transit from Goalundo to the port nearest to the place of their employment fell from 2·6 per 1,000 to ·9 per 1,000, which shows, in the provincial Sanitary Commissioner's opinion, that greater precautions are taken on the steamers, and greater care exercised not to embark infected coolies. As low and lower rates have, however, been recorded even as far back as 1890 and 1893.

Bengal.—In Bengal in 1902 the total number of deaths recorded as due to cholera was 150,971, or 2·02 per 1,000 of the population, as compared with 110,753 or 1·48 per 1,000 in 1901. The disease appeared in every district during 1902, attacked 22,642 villages and assumed an epidemic form in 67 registering circles, as compared with 43 in 1901. The highest district ratios were those of Muzaffarpur, 24-Parganas, Howrah, Nadia, and Faridpur, while Ranchi and Darjeeling were the least affected of all the districts. As compared with 1901, the incidence of the disease during 1902 was higher in all but 11 districts. The highest municipality and town death ratios were 27·46 per 1,000 in Sitamarhi in the Muzaffarpur district, 16·31 in Kotrung, and 12·34 in Baidabati, both in the Hooghly district. The ratios of 27 other towns ranged from 5 to 11·67 per 1,000. The provincial Sanitary Commissioner offers no remarks on the increased prevalence of cholera during 1902. In 20 districts during the cholera outbreaks, the tanks and wells used for drinking purposes were disinfected with permanganate of potassium, and the Sanitary Commissioner remarks that though in most places no systematic record of results was kept, the measure is generally said to be attended with beneficial results. Among the European seamen of the port of Calcutta there were 13 deaths from cholera, and there were 63 among the native floating population.

United Provinces.—Although in 1902 the cholera death-rate in the United Provinces was the fourth highest among the provinces, the mortality from this disease was considerably less than in 1901. The total number of deaths from cholera recorded was 25,160, giving a ratio of ·53 per 1,000 of population, as compared with a total of 53,995 and a ratio of 1·13 during 1901. The disease caused the greatest number of deaths in May and the fewest in February. The highest district death-rates in order were those of Banda, Garhwal, Naini Tal, Basti, Fyzabad, and Allahabad, and the highest town mortalities those of Banda (14·8 per 1,000), Kashipur (11·14 per 1,000), and four other towns with ratios ranging from 5·48 to 3·08. In 57 towns no death from cholera was recorded.

Punjab.—Although cholera was slightly more prevalent in the Punjab during 1902 than during 1901, the province was, as in the previous year, almost entirely free from the disease. The total number of deaths recorded was 371, giving a ratio of ·02 per 1,000, as compared with a ratio of ·01 in 1901, and a mean mortality ratio for the previous five years of ·27. With the exception of an isolated outbreak, which occurred in December in the Kangra district, the disease was almost entirely confined to a few

districts in the Delhi division. The largest numbers of deaths were recorded in the Umballa and Gurgaon districts. The Civil Surgeon of the Kangra district gives the following account of the outbreak there :—

"There were 66 seizures with 38 deaths in the village of Sansai during the month of December, 1902. The infection was brought to the village by a sepoy returning from Burma ; after the man's death, his wife washed his clothes in the tank from which one half of the village procured their drinking water. The village is divided into two parts by a rivulet, and each half of the village has a separate spring and tank for drinking water. One half of the village had no cases of cholera, whilst the other half, the water supply of which had been polluted, developed 65 cases of cholera in seven days. The inhabitants ceased to use the infected water and the tank was disinfected with permanganate of potassium. The cases ceased immediately.

North-West Frontier Province.—No death from cholera was recorded in the North-West Frontier Province during 1902. In 1901 the total number of deaths was 117, a ratio of ·06 per 1,000 of population.

Bombay Presidency.—In the Bombay Presidency the death-rate from cholera during 1902 was between one-fourth and one-fifth that of 1901. Since 1877 there have been only two years, viz., 1880 and 1886, in which a smaller mortality from cholera was recorded than in 1902. Out of 220 rural circles 34 were affected by cholera in 1902, but in nine only was it prevalent to any extent. The highest percentages of affected villages were in the collectorates of Karachi and Hyderabad, and in the remaining 16 affected collectorates less than one per cent. of the villages were attacked by the disease. The Deputy Sanitary Commissioner, Sind Registration District, considered, after very careful enquiry, that the disease was most probably imported into that district by immigrants entering Sind viâ the Thar and Parkar district.

Berar.—Only 16 deaths from cholera were recorded in Berar during 1902, as compared with 17 in 1901 and 18,375 in 1900. The number of deaths from this cause during 1902 in Berar is the lowest since 1880, except 1898 when the province was free from the disease. The whole province was free from the disease except the village of Hingna Gawhal in the Buldana district, where a small outbreak causing 16 deaths out of 48 attacks occurred in May. The Sanitary Commissioner of the Hyderabad Assigned Districts says that it was discovered that the infection was brought by a party returning from pilgrimage to Upper India and Bengal. The speedy disappearance of the disease was said to have been aided by disinfection of the drinking water-supply with permanganate of potassium.

Central Provinces.—The Central Provinces also remained almost entirely free from cholera during 1902, only 28 deaths being recorded from this disease, as compared with 49 in the previous year. With the exception of the year 1898 the figures for 1902 are the lowest on record. Of the 28 deaths, 26 occurred at Bilaspur and one each at Marwara and Bhandara. The two latter cases were said to have been imported from Allahabad and Benares, respectively. The origin of the outbreak in Bilaspur could not be satisfactorily explained.

Madras Presidency.—In the Madras Presidency there were 29,769 deaths recorded as due to cholera during 1902, giving a ratio of ·8 per 1,000 of population, as compared with a total of 81,370 and a ratio of 2·2 per 1,000 in 1901. The districts of Tinnevelly, Tanjore and Bellary were most severely affected. The provincial Sanitary Commissioner points out that the difference of incidence of cholera in municipalities during 1902 is slightly in favour of those municipalities which adopted the so-called municipal cholera rules as a compulsory measure, and notes with satisfaction that certificated sanitary inspectors are slowly displacing in rural areas the untrained conservancy overseers. In the larger towns considerable attention has been paid to water-supplies, and some slight advance has been made in this direction in rural areas.

Coorg.—No death from cholera was recorded in this small province during 1902. There was also no cholera in Coorg during 1899 and 1900, but in 1901 the disease caused 58 deaths.

Burma.—In Lower Burma during 1902 there were recorded as due to cholera 1,844 deaths, or a ratio of ·33 per 1,000 of population as compared with 3,552, or ·64 per 1,000, from the same cause in 1901. The number of deaths during 1902 is the

lowest since 1890. The largest numbers of deaths in districts were 471 in Thôngwa, 288 in Henzada, 237 in Bassein, and 200 in Myaungmya, and the highest rates in towns were 6·05 per 1,000 in Kyaiklat, 4·37 per 1,000 in Zalun, and 4·30 per 1,000 in Yandoon. In four districts and in 15 towns no death from cholera was recorded. The total number of persons reported to have been attacked by the disease was 1,944, and the high case mortality (95 per cent.) indicates that a large number of attacks were not reported. As regards seasonal distribution, the disease was most prevalent in April, March and February, and the fewest deaths occurred in September, October and August.

In Upper Burma the total number of deaths recorded as due to cholera during 1902 was 57. Four districts and 10 out of the 13 towns returned no death from this cause, and of 9,340 villages, from only 20 were cholera deaths returned.

Anti-cholera inoculation.—In the year 1902 the total number of operations performed at the Purulia depôt in Bengal, the only place where inoculation is systematically carried out, was 3,144, as compared with 3,453 in 1901 and 13,291 in 1900. The subjects were all coolie emigrants proceeding to the tea districts of Assam and Cachar. The large decrease is mainly due to the fact that while formerly all the coolies recruited from the Central Provinces as well as from the districts of Palamau and Ranchi used to halt at Purulia where they were inoculated, they now do not break their journey at Purulia, but proceed viâ Asansol to the labour districts of Assam. Since the close of the year 1902, however, arrangements have been made to have all these coolies inoculated at Asansol. Out of 106 inoculated coolies on board the steamer plying between Goalundo and Dibrugarh, it is reported that only one man got cholera and he recovered, while out of 1,192 uninoculated coolies, 18 are said to have been attacked by it, four of the cases ending fatally.

Small-pox.

The death ratio per 1,000 of population from small-pox during 1902 rose by ·12 per 1,000 as compared with that of 1901. The total number of deaths was 115,443 as compared with a total (excluding Upper Burma) of 89,378 in 1901, and a total of 84,780 in 1900. The mortality ratio from small-pox in Assam was very much higher than in either of the two preceding years, chiefly as a result of several outbreaks in the districts of the Surma valley. The provincial Sanitary Commissioner attributes the outbreaks largely to the visits of inoculators. The disease was also very prevalent in the Hailakandi subdivision of the Cachar district where inoculation was largely practised.

Statement showing the deaths from Small-pox registered in British Provinces by Months during the year 1902.

Provinces.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Ratio of deaths per 1,000 of population.	
													1902.	1902.	1901.
Bengal	4,306	6,273	10,498	11,026	8,328	6,163	3,706	1,876	1,395	686	992	2,181	57,430	0·77	0·50
Assam	675	807	1,210	1,130	1,088	571	337	255	175	95	103	227	6,673	1·26	0·62
United Provinces	113	105	288	599	923	874	566	430	244	120	194	520	4,976	0·10	0·02
Punjab	796	972	1,235	1,544	1,902	1,593	1,010	609	335	272	441	920	11,629	0·58	0·31
North-West Frontier Province.	61	100	88	76	108	112	94	60	53	48	113	168	1,081	0·54	0·47
Central Provinces*	326	349	446	523	629	531	371	277	214	153	224	191	4,234	0·47	0·66
Berar	23	41	64	71	63	29	20	8	5	2	—	1	327	0·12	0·07
Lower Burma	107	110	321	320	236	177	68	38	46	58	41	43	1,565	0·28	0·44
Upper „	15	30	36	77	89	35	15	6	4	10	16	17	350	†	†
Madras Presidency	2,758	3,461	3,714	2,257	1,921	1,474	1,777	1,580	1,396	1,458	1,531	1,640	24,967	0·69	0·72
Bombay „	276	384	443	329	222	141	128	60	44	32	33	97	2,189	0·12	0·29
Ajmer-Merwara	—	—	1	1	1	—	—	—	—	—	—	—	3	0·01	0·01
Coorg	—	2	4	3	2	3	2	1	2	—	—	—	19	0·11	2·48
Total	9,456	12,634	18,348	17,956	15,512	11,703	8,094	5,200	3,913	2,934	3,688	6,005	115,443	0·52	0·40

* Excluding Chhatisgarh Zamindaris † Not available.

The prevalence of small-pox in Bengal has been increasing steadily since 1899, and during 1902 caused 19,750 more deaths than during 1901, the number of deaths from this cause during 1902 reaching the high total of 57,430. The provincial Sanitary Commissioner remarks that the present arrangement by which vaccination in outlying tracts is practically left to the unchecked supervision of the subordinate inspecting staff, is risky and defective, and proposals have been submitted to Government to remedy this state of things. In the United Provinces the death-rate during 1902 was five times as high as during 1901. In the Punjab the ratio was nearly twice as high as in 1901 and the total number of deaths 11,629 as compared with 6,154 in 1901. The provincial Sanitary Commissioner points out that in the districts in which small-pox was very prevalent during the year 1902 the number of persons successfully vaccinated per 1,000 of population was, with one or two exceptions, lower than the average for the province. It is satisfactory to observe that in the 22 towns in which vaccination is compulsory the mortality from small-pox was comparatively low, viz., ·6 per 1,000 as compared with a death-rate for all the towns of ·9 per 1,000. In the North-West Frontier Province the mortality from small-pox was slightly increased. The Civil Surgeon of Dera Ismail Khan considered that many deaths from measles were recorded as having been due to small-pox. In the Bombay Presidency the death-rate from small-pox in 1902 was less than half that in the previous year, but in Berar the death-rate was higher than in 1901. In the Central Provinces, in the Madras Presidency, and Lower Burma the mortality decreased considerably as compared with the previous year, and there was very little small-pox in the towns of Upper Burma.

Plague.

The mortality from plague in India was first shown in a separate table in this report for 1898. During that year 98,613 deaths from the disease were recorded, and in the next year the number of recorded deaths reached a total of 139,009. In 1900, however, there was a decided decrease in plague mortality, only 92,807 deaths being recorded, but in 1901 the number, viz., 283,788, far exceeded the combined totals of the two previous years. In 1902 a still further increase occurred, no less than 583,937 deaths being attributed to this disease alone, a mortality which is not less than that of cholera in a year of severe epidemic. In 1898 the month of maximum prevalence of plague was October, but for the three years from 1900 to 1902 the month of highest mortality was March, and for each of the five years except 1900, when it was July, the month of minimum prevalence was June. During 1902 all the provinces of India were more or less affected except Assam, Burma, and Coorg, where no deaths from plague were recorded, the North-West Frontier Province where only 4 deaths were recorded, and Ajmer-Merwara where only one death was recorded.

A résumé of the literature bearing upon plague has been given in this report in former years, and a few references to recent contributions will be given here, although it may be noted that there is much apparent inconsistency in the results recorded by different observers.

The bacillus.—As a result of a bacteriological and pathological examination of 2,200 rats among those killed in connection with the outbreaks of plague at Odessa, Skschivan arrives at the conclusion that there exists absolutely no difference between the bacillus of rat plague and that of human plague, the disease in rats and in men being in fact caused by one and the same bacillus. The assertion of Caldas, referred to in the last report, that the human plague bacillus is but a rat colon bacillus of high virulence, is quoted by Pfaundler as an example of the fantastic conclusions into which a want of the critical faculty in research can lead observers. True plague bacilli are not, however, always found in rats suspected to have died from plague. E. Klein isolated a bacillus from dead rats found in a ship arriving in Bristol which, though very like the plague bacillus, really stood as regards its cultural characters between the *B. coli* and the *Bacterium lactis aërogenes;* and Skschivan in the experiments just referred to, found that a plague-like disease of rats might be caused by the *B. mucosa capsulata* and by bacilli of the coli group. Lochmann has also found a new bacillus of the coli group which is pathogenic for mice and guinea-pigs, and Edington found in rats suspected to be dead of plague a bacillus very like the plague bacillus, but differing from it in its morphological characters and in its pathogenic effects on other animals. Galli-Valerio has pointed out that the *B. pseudo-tuberculosis rodentium* is very like the plague bacillus morphologically and culturally, and that confusion in the diagnosis

of plague by the inoculation of guinea-pigs might result if the former bacillus were already present in the guinea-pigs ; but Favre says that in spite of their known resemblance it is not difficult to distinguish them. Dieudonné draws attention to the value of the speedy appearance of involution forms in Hankin's salt agar medium as a means of differential diagnosis between the plague bacillus and other similar kinds, and Maassen, among others, corroborates the value of the skin-rubbing method for the discovery of the bacillus in suspected material, especially when such material is contaminated with other microbes, and when it is desired to study the vitality of the bacillus in fæces or other matter. He found that in the dried excrement of rats the plague bacillus did not remain alive more than one day, but that if the excrement were kept from drying it could retain its vitality up to the fourth day. Dieudonné says that the vitality of the plague bacillus in different media outside the body depends on the number of saprophytic organisms present and on the surrounding temperature ; the greater number of saprophytes and the higher the temperature, the shorter is the life of the bacillus. The plague bacillus is indeed but very slightly susceptible to cold, and Toyama has shown that a plague culture after two months' exposure to the cold of winter in Tokio showed no difference in growth from a similar culture kept in an incubator, and its virulence after three months was unchanged. whereas the virulence of a control culture kept in the incubator had decreased considerably after 84 days. Drying, however, kills the bacillus quickly, and Dieudonné points out that alternations of dryness and moisture are also very injurious to its vitality. Inghilleri found that in distilled, sterilized water the plague bacillus can retain its vitality for 60 to 75 days at 35° C., and for 30 to 60 days at 18—20° C. In some of the potable waters of Rome the bacillus was alive in one case after 35 days, in another after 33 days, and in another after 28 days. Burnet however remarks that the experiments of Inghilleri were made under very artificial conditions, and that the plague bacillus retains its vitality better under natural conditions than under artificial ones. According to him if the experiments are made under conditions as nearly as possible approaching those which would be met with in nature, living plague bacilli can live in water 120 days.

Mode of spread. Rats and other animal carriers.—According to Dieudonné the spread of plague results through the agencies of human beings and human traffic on the one hand and through rats on the other. The consensus of opinion of 37 correspondents with experience of plague epidemics, quoted by Simpson in his report on plague in Hong Kong, favoured the view that the infection was carried from place to place by individuals and from house to house by rats. Thirty of the correspondents had found that the plague outbreak was preceded by a mortality among rats, and only four that the rat mortality was simultaneous with the plague outbreak. Dieudonné gives several instances in support of the view of Koch and others that plague is essentially a disease of rats, which only after some time spreads to man from these animals. The German Commission were of opinion that rats take an essential share in the maintenance of the disease in its endemic centres, an opinion which finds support in the important observation quoted by Dieudonné that rats can suffer from a chronic form of the disease, so that plague germs can remain for a long time in the bodies of these animals, and from time to time originate an epidemic among them. Rabinowitsch and Kempner, in reporting on the plague epidemic at Odessa, considered that the disease was spread directly by rats, and Gamaleia that it was spread through the medium of cereals infected by the urine and fæces of plague-infected rats. On the other hand Flexner, in an account of the epidemic at San Francisco, says that rats took no part in the spread of the disease there, and no sick or dead rats were found. In the outbreak of plague at Manilla, in the Phillipines, rats were caught, labelled, and sent alive to the laboratory to be examined—a better procedure than taking only dead rats. During the first two weeks in which this method was carried out, 1·8 per cent. of the rats caught were found infected, and during the month of October 2·3 per cent. Out of 3,274 dead rats examined in connection with a recent outbreak of plague at Brisbane only 25 were found infected. The importance of ship rats in the spread of plague has been drawn attention to by Kossel and Nocht, Skschivan, Nocht and Giemsa, Dieudonné, and others. Nocht and Giemsa say that for the spread of plague from harbour to harbour the rats on board sea-going ships must be held responsible, and they agree with Kossel and Nocht in saying that scarcely a single instance of an outbreak of plague in a sea-port town has been traced to infected human beings. Skschivan is also of the same opinion as to the importance of ship rats in the spread of the disease, though he says that ship-rat plague is not always followed by human plague, and that in the East rat and human plague are not always coincident. Mice can also take part in the spread of plague, and Gotschlich, Thompson, and others have given instances in which plague-infected mice were found. Three mice were also

found infected with plague bacilli in the Brisbane outbreak referred to above. Simpson found in Hong Kong that pigs, calves, buffaloes, sheep, hens, ducks, geese, turkeys, and pigeons are, in addition to rats, susceptible to plague, and especially so when fed with plague material. His experiments also showed that the infective material of a plague rat can cause plague in monkeys by feeding or by inoculation, and the infective material of a monkey with plague can give rats plague. Wilm had previously observed that spontaneous plague infection sometimes occurred among pigs in Hong Kong. The German Commission, however, found that Indian pigs are almost completely insusceptible to subcutaneous inoculation of plague bacilli, and Di Mattei made a similar observation as regards the pigs in Italy. Albrecht and Ghon also fed young pigs with large quantities of plague material for some weeks without result, and they also obtained negative results by different methods of infection of plague bacilli with hens, geese, and pigeons.

Mode of infection. Fleas and other insects.—Dieudonné says that the communication of plague from man to man can occur either directly from a diseased man or indirectly through the medium of infected dwellings, linen, clothes, or utensils. From the point of view of direct infection all the severe septicæmic cases are dangerous ; but the most so are the lung cases, in which the sputum, loaded with bacilli, is sprayed about when the patient coughs or even when he speaks. Mild cases which may take the form of only a simple bronchitis, and convalescents from the pneumonic form of the disease, whose sputum may contain plague bacilli for weeks or even months after convalescence has begun, also play a large part in the spread of the disease. The method by which plague is communicated from the rat to man is not yet known. Above all, says Dieudonné, plague-stricken rats are dangerous in that they evacuate plague bacilli with the urine and fæces which they deposit in every room into which they go, and the bacilli thus spread in dark damp rooms are capable of living for a long time. The opinion of Simond that fleas can communicate plague from rat to rat and from rat to man has been opposed by Galli-Valerio, Nuttall, Kolle, and others. Gauthier and Raybaud, however, report that they have succeeded in infecting a healthy rat by the bites of fleas taken from an infected one, and also that the fleas of rats will bite human beings. Tiraboschi divides the fleas infesting rats into those that do not bite man (*Ceratophyllus fasciatus* and *Ctenopsylla musculi*) and those that do (*Pulex serraticeps* and *Pulex irritans*) ; only fleas of the latter kind are therefore capable, according to him, of communicating plague from rat to man. Tidswell made a collection of rat fleas in connection with the plague epidemic at Sydney. Out of 100 fleas obtained 10 were identified as *Pulex fasciatus*, 8 as *Typhlosylla musculi*, 1 as *Pulex serraticeps*, and 81 as *Pulex pallidus*. *Pulex pallidus* and *Pulex fasciatus* bit human beings in laboratory trials. All of 50 specimens of fleas caught on rats in India examined by Captain Liston, I.M.S., were identified as *Pulex pallidus*, and of 28 specimens caught on man 27 were identified as *Pulex irritans* and one as *Pulex canis*. Dieudonné says that experience in Bombay and in other epidemics goes against there being any considerable danger from the bites of infected fleas, while the fact that plague seldom occurs among the attendants in plague hospitals points also to the fact that mosquitoes play little or no part in the spread of the disease. He considers, however, that fleas and other biting insects may be of some significance, in that the wounds caused by their bites may afford a point of entrance for plague germs present on their bodies or legs, or even on the clothes of the person bitten. Flies are also of some significance in that they can convey plague bacilli from sputum or excrement on to utensils and food.

Measures against rats.—The Clayton process for the disinfection of ships and the destruction of ship-borne rats has been favourably reported on by Calmette and Hautefeuille, and adopted by some of the large shipping companies. Freer, however, says that the employment of sulphurous acid gas has many disadvantages, and can be used only if all the stores and a considerable amount of woodwork are removed, and that it will not kill rats unless it is very condensed. Nocht and Giemsa also point out that many kinds of merchandise, especially fresh fruits, flour, and meat, take up large quantities of sulphurous acid and are quickly changed by it ; also that by its repeated use the hulls of ships are affected, and the steel parts quickly and deeply rusted. They have invented an apparatus for the employment of carbonic oxide gas, which is free from these disadvantages. The apparatus was tried with success on some of the ships of the Hamburg-America line. Haldane had previously recommended the use of carbonic oxide gas, but his experiments were not carried out on such a large scale as those of Nocht and Giemsa. Abel has made experiments on the destruction of rats with the bacillus of Danysz, and considers that the method is a promising one, but requires to be experimented with more extensively. Oettinger considers that several different kinds of bacteria

are called by the name of the Danysz bacillus, but that none of them can have their virulence exalted by the method of Wiener in such a way as to make them practically useful in the destruction of rats. Colonel King, I.M.S., has reported favourable results in causing the disappearance of rats from houses and in preventing them from effecting an entrance to any house, by the use of a mixture of tar and sulphuric acid, which is spread in the entrance of all rat holes or in a circle round the building which it is desired to protect.

Statement showing the deaths from Plague Registered in British Provinces by Months during the year 1902.

Province or State.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total. 1902.	Total. 1901.
Bengal	2,950	4,542	7,962	6,067	2,037	393	115	85	140	578	1,792	6,306	32,967	78,629
Assam	—	—	—	—	—	—	—	—	—	—	—	—	—	—
United Provinces of Agra and Oudh.	3,847	6,548	9,254	4,717	1,138	170	28	606	2,238	3,927	4,299	6,715	43,487 *	9,778
Punjab	12,009	23,155	51,945	48,840	20,694	3,036	334	195	420	1,846	4,207	8,964	175,645 *	16,720
North-West Frontier Province.	—	—	1	2	1	—	—	—	—	—	—	—	4	—
Punjab Native States (Kapurthalla, Patiala, Nabha Kalsia, Malerkotia, Bhawalpur. Jhind, Nalagarh, and Bughat).	1,430	6,455	16,490	13,743	6,335	411	34	66	42	199	550	1,135	46,890	2,157
Jummu and Kashmir State.	1,328	1,901	1,108	995	344	7	—	—	—	—	—	7	5,690	1,852
Central Provinces ...	4	22	27	4	—	—	—	1	11	12	25	353	459 *	9
Berar	—	24	130	230	12	—	—	85	494	822	1,118	1,273	4,188	—
Burma	—	—	—	—	—	—	—	—	—	—	—	—	—	3
Madras Presidency ...	2,417	1,947	1,007	198	53	94	231	574	1,056	1,006	1,186	1,593	11,362 *	3,035
Madras Presidency (Native States).	No returns received.													
Bombay	16,753	17,904	18,089	8,020	2,416	1,539	4,018	11,855	23,625	27,026	23,000	30,507	184,752	128,259
Bombay Presidency (Native States).	3,777	2,896	3,036	3,552	1,090	306	703	2,353	4,758	6,631	4,219	5,269	38,590	29,821
Baluchistan	—	1	1	—	10	7	11	—	—	—	—	—	30	—
Ajmer-Merwara ...	—	1	—	—	—	—	—	—	—	—	—	—	1	—
Rajputana, Marwar State, Jaipur State, Sirohi State, Mewar, Alwar, Bikaner.	2	13	96	24	6	1	—	—	—	2	5	—	149	185
Central India	—	—	—	—	—	—	—	—	1	66	26	315	408	—
Coorg	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mysore	2,541	2,075	1,106	526	416	576	1,156	2,503	3,725	4,268	3,817	3,592	26,301	11,936
Bangalore Civil and Military Station.	473	297	202	77	30	57	85	166	378	897	857	561	4,080	1,255
Hyderabad State ...	418	563	275	138	—	—	—	286	602	1,305	2,430	2,917	8,934	149
Total ...	47,949	68,344	110,729	87,133	34,582	6,597	6,715	18,775	37,490	48,585	47,531	69,507	583,937	283,788
Calcutta City	225	721	2,206	2,531	984	258	75	65	48	34	43	88	7,278	7,883
Bombay „	1,297	2,528	3,596	2,788	1,176	269	129	152	230	536	515	570	13,786	18,694
Madras „	—	1	1	—	—	—	—	3	1	1	2	1	10	3

* These figures do not agree with those given by Provincial Sanitary Commissioners in their annual reports. In the case of the Punjab the figures here used have been supplied by the Chief Plague Medical Officer of the Punjab. In the case of the United Provinces they are those supplied by District Magistrates who obtain their figures mostly from special Plague Medical Officers. In the cases of the Central Provinces and Madras they are those supplied to the Local Governments.

Bengal.—The total number of deaths recorded as due to plague in Bengal during 1902 was 32,967 as compared with 78,629 during 1901. The Sanitary Commissioner remarks, however, that this decrease was probably more apparent than real, and was

evidently due to the inclusion under the heading of "fever" of numbers of deaths from the septicæmic form of plague which largely prevailed in parts of Bihar. Plague prevailed with the greatest intensity in Calcutta, where 8·58 per 1,000 of the population fell victims to it during 1902 against 9·29 during 1901. In Patna, where a ratio of 16·86 per 1,000 was recorded in 1901, a mortality of only 1·71 per 1,000 was recorded in 1902. The Civil Surgeon of Saran reports that there appeared to be two factors in the spread of the disease; the amount of human intercourse and the agency of rodents. The parts of the district most affected were along the lines of communication, especially the river and railways, and the more outlying and secluded parts were almost entirely free from the disease. Rats, mice, and squirrels all suffered severely from the epidemic, and were constantly found lying dead in infected areas. "Both these sources of infection are thoroughly appreciated by the people themselves and influence them in their efforts to protect themselves from the disease." The Sanitary Commissioner says that the feeling of the people was against anti-plague inoculation, and for this reason only a small number of inoculations were performed in the districts of Saran, Patna, and Darbhanga. Disinfection also, he says, is not generally liked by the people, but evacuation of infected houses is in great favour with them. This is done spontaneously and generally fairly thoroughly by the people themselves without outside interference, and the benefit of the timely exodus is most marked.

City and port of Calcutta.—The mortality from plague in the city and port of Calcutta was rather less during 1902 than during the two previous years. A special department, independent of the health department, undertook the administration of the disease and reliance was placed mainly upon disinfection. Eighty-nine vessels were boarded on arrival from plague-infected ports, but no case of plague was found on any of them. Among the crews and passengers of outgoing vessels no case was detected.

United Provinces.—In the United Provinces there was a great increase in the mortality from plague, 43,487 deaths being recorded from this cause during 1902, as compared with 9,778 during 1901. The disease was most prevalent in March and least so in July. Deaths were reported from no less than 34 districts. Among towns the highest death-rates were 4381 per 1,000 at Jaunpur, 36·69 at Cawnpore, 31·10 at Gorakhpur, 30·76 at Ballia, and 25·86 at Barhaj. The higher proportion of deaths among females than among males was attributed to the facts that native females spend more time inside their houses and courtyards than men and do not habitually wear shoes.

Punjab.—The mortality from plague in the Punjab during 1902 was more than 10 times as great as that of 1901 and accounted for no less than 175,645 deaths, a total which, with the exception of that of Bombay, is over three-and-a-half times as high as that of any other province in India during 1902. The epidemic broke out in the winter months of 1901, the number of deaths increasing month by month to a maximum in March and April of 1902. The disease was confined during the year chiefly to the central and thickly-populated portion of the province. In the district of Ludhiana 71 per 1,000 of the population died from plague, and in the districts of Umballa and Sialkot 30 and 26 per 1,000 respectively. Next came Jullundur, Gurdaspore, Hoshiarpur, and Lahore districts. The Civil Surgeon of the Ludhiana district gives instances of 22 villages in which the enormous death-rates of from 20 to 40 per cent. of the population were registered. As a rule rats were found dying in every village before the commencement of outbreaks of the disease among the inhabitants, and those villagers who on the discovery of rats dying left their houses and did not visit them again mostly escaped. In the whole province the recorded proportion of deaths from plague among males and females was approximately as 7 : 10.

Owing to the rapid extension of the area infected with plague in the Punjab in the winter of 1901–02, the impossibility of inducing the people to adopt measures of segregation and evacuation with sufficient thoroughness, and the consequent difficulty in rendering disinfection effective, the local Government obtained the sanction of the Government of India to a scheme for inoculation on a great scale. It was proposed to begin operations on the 1st September, 1902, and to inoculate seven millions of the people before the end of March, 1903. To do this every member of the provincial medical establishment who could be made available was employed, five medical officers were obtained from the military authorities, and 37 medical men were specially engaged in England. But the scheme was unfortunate from the beginning. Owing to the magnitude of the demand, the manufacturing laboratory was not at first able to supply

the quantity of prophylactic required, and the commencement of operations had to be deferred until the 1st of October, while the deplorable catastrophe at Mulkowal where, early in November, 19 persons died of tetanus after inoculation from the same bottle of fluid, not only brought operations temporarily to a standstill, but made the people unwilling to subject themselves to inoculation.

The results of the inoculation campaign in the Punjab, of which a detailed report is under preparation, are given in the following statement :—

Year.	Total number of plague—		Percentage of total deaths to total cases.	Total number of inoculations performed.	Inoculated persons.		Percentage deaths to attacks among inoculated persons.
	Cases.	Deaths.			Attacked.	Died.	
1902–03.							
1st October, 1902, to 23rd May, 1903.	299,303	178,849	59·8	480,737	4,667	1,158	24·8

North-West Frontier Province.—Only four deaths from plague were recorded in this province during 1902, all of which were said to have been imported from the Punjab. The measures taken to prevent the spread of the disease were attended with success.

Central Provinces.—The total number of deaths from plague officially recorded in the Central Provinces during 1902 was 459 as compared with nine in 1901. The Provincial Sanitary Commissioner, however, considers the number of deaths from this disease during 1902 to have been at least 1,061. The history of indigenous plague is confined to outbreaks at Loni and two other villages in the Nimar district, and outbreaks in the town of Burhanpur, the city of Jubbulpore, and the small town of Pulgaon in the Wardha district. The outbreak at Loni commenced on the 3rd of February and lasted until the 25th of March. In the case of this outbreak, as well as in that occurring in the town of Burhanpur, the infection was traced to infected areas in the Khandesh district. In Burhanpur the outbreak commenced at the end of October, and, despite active measures, became more and more severe and continued into the present year. At Jubbulpore plague was present some little time before it was officially recognised, and owing to the concealment of first cases by the people, the disease had obtained a firm hold of the town before measures against it were initiated. The endeavours subsequently made were unavailing and a widespread epidemic ensued.

Bombay Presidency.—The largest number of deaths from plague in any province was again recorded in the Bombay Presidency, the disease accounting for 184,752 deaths as compared with 128,259 deaths in 1901. The mortality from plague in this presidency during 1902 is the highest recorded since its first appearance in 1896. All the collectorates in the presidency, except Upper Sind Frontier, were affected.

City and port of Bombay.—In the city of Bombay 13,786 deaths from plague were recorded during 1902 as compared with 18,694 in 1901. The disease was present throughout the year, the month of maximum prevalence being March and of minimum prevalence July. At the inspections of outgoing and incoming vessels and of vessels lying in the harbour, 44 cases of plague were detected. Among the passengers and crew sent to the port observation camp, 28 developed plague and were transferred to the various hospitals in the city for treatment.

Berar.—In 1902 for the first time since the commencement of the present epidemic in India, plague made its appearance in Berar and caused 4,188 deaths. It is said that at first evacuation of houses was resorted to by the people only after the disease had wrought havoc among them, but that by experience they afterwards learnt that their only safety lay in vacating an infected village as soon as possible. Disinfection and "desiccation" were carried out to some extent in all infected areas, and much inoculation work was done. It was noticed that besides rats and squirrels, many monkeys died of plague.

Madras Presidency.—The total number of deaths recorded as due to plague in Madras during 1902 was 11,362 as compared with 3,035 in 1901. The only district, however, which was severely affected during 1902 was Bellary, in which 7,354 deaths

from plague were recorded, the district of Salem coming next with a total of 1,668 deaths. The Sanitary Commissioner says that the territory under the Government of Mysore continued to be a special danger to the presidency, in that excepting measures taken in the cities of Mysore and Bangalore, very little attempt at organisation for checking the spread of the disease exists in that area. He considers that the system of surveillance, without detention, of all travellers passing from infected areas to uninfected areas, so arranged that to whatever part of the Madras Presidency they journey, surveillance proceeds uninterruptedly for a period of 10 days, is fairly efficient. Where rural areas are imminently threatened by plague, special staffs composed of certificated sanitary inspectors are placed on duty, so as to strengthen the executive of the existing district staffs and thus keep each inhabited area under systematic observation. Railway inspection was used only where it was possible to protect a still uninfected area, and during the year 176 cases of plague were withdrawn from the railway trains at Jalarpet, the point where cases from the Mysore territory are received. The Provincial Sanitary Commissioner considers that experience in the Madras Presidency shows that man causes the rat to suffer and not the rat the man in the first place, that the area over which infected rats roam is usually small, and that recrudescence is by no means a natural feature of the disease, but a very natural result of apathy or of too optimistic treatment of an indigenously infected area.

Burma.—Only three imported cases of plague were detected in Burma during 1902. Only one of these cases was fatal, and a bacteriological examination yielded negative results.

Baluchistan.—In Baluchistan 30 deaths from plague were reported during 1902. No death was recorded during the previous year. Sonmiani, a small town on the sea coast, was the only place where an outbreak occurred. It is said that infection was brought from Karachi. The town was entirely evacuated and disinfected, and the outbreak, which had caused 28 deaths, ceased. The other two deaths occurred at Sibi, but both the cases were imported.

Rajputana and Ajmer-Merwara.—In Rajputana 149 deaths from plague were recorded during 1902 as compared with 185 during 1901. The disease appeared in the villages of Karnikot and Khuteta in the Ulwar State and in the village of Duthariya in the Marwar State. It is said that the deaths recorded as due to plague in Khuteta were in all probability due to cerebro-spinal meningitis and not to plague. Only one suspected case of plague, which terminated fatally, was recorded in Ajmer-Merwara.

Central India.—There was no plague anywhere in Central India in 1902 until the last week of September. The disease was very prevalent at that time in Khandesh and Nimar in the Central Provinces and probably spread from thence to Central India. The most severe outbreak occurred at Khasroad, a village in the Bhopawar agency. Evacuation of the infected portion of the village and disinfection of infected houses were carried out. During the year 1,275 persons were inoculated, of whom two were attacked by plague one month after inoculation.

Mysore.—The total number of deaths from plague recorded in Mysore (excluding Bangalore civil and military station) during 1902 was 26,301 as compared with 11,936 in 1901. "Desiccation" of the interiors of infected houses is said to have been introduced in various parts of the State, and "the result is being carefully watched."

Hyderabad State.—The mortality from plague in the Hyderabad State during 1902 was nearly 60 times as heavy as during 1901, the total deaths recorded amounting to 8,934. To this total the district of Aurangabad contributed 7,581, the district of Oosmanabad 1,089, the district of Kopbal 182, and the district of Raichur 74. In the remaining four infected districts eight deaths in all were recorded.

Fevers.

The total number of deaths recorded as having been due to fevers during 1902 was 4,279,551, or a ratio of 19·17 per 1,000 of population, as compared with a total of 4,174,919, or a ratio of 18·73 during 1901. The heading "fevers" includes the deaths from a large number of different causes, and it is not possible to say with any approach to

accuracy what proportion of the fever death-rate in India as a whole, or in any province, is due to malaria. The fact, however, that the malarial fever ratios for European troops, native troops and prisoners were all lower in 1902 than in 1901, is perhaps some indication that the rise in the ratio for fevers among the general population was not altogether due to an increase in malarial fever. A very large increase in the prevalence of plague occurred during 1902, and it is probable that, as in previous years, many deaths from plague were recorded as having been due to "fever." The greatest number of deaths from fever was recorded as usual during the last four months of the year, and the fewest in July. As compared with the previous year an increased number of deaths was recorded in all the months of the year except January, July, October and December, the greatest increase occurring in May. In Bengal the fever death ratio was the highest recorded since 1897, being also considerably higher than the mean ratio for the previous five years. The unusually high mortality from fever in April is attributed by the provincial Sanitary Commissioner to the fact that some of the deaths from plague, which was very prevalent at that time, were wrongly returned under the heading of fever. A mortality of over 30 per 1,000 was recorded from nine districts in 1902 as compared with four districts in 1901. Fevers were not so prevalent during 1902 in Assam as in 1901. The Sanitary Commissioner says that the decrease was well marked in both valleys, though certain districts in the Brahmaputra valley showed a rise, notably Darrang where the increase is suspected to be due to an increase in *kala azar*. The number of deaths attributed to *kala azar* in the Sylhet district has also increased considerably, apparently as the result of a special investigation having been made into the true extent of the disease there. In the Goalpara district, however, the number of deaths returned as due to this disease are very few in comparison with the number so returned in former years, in spite of the fact that this is the district in which malarial fevers are most prevalent. In the United Provinces the death-rate during 1902 was higher by 1·05 per 1,000 than that of 1901. During the year a circular, giving instructions for dealing with mosquitoes and their larvæ, was issued to all District and Municipal Boards, Civil Surgeons, and special health officers, and in some localities efforts were made to give effect to the suggestions, although no measures on a large scale were attempted. In the Punjab a further decrease in fever mortality occurred during 1902. The highest district ratios for the year were those of Hissar, Rohtak, Gurgaon, Delhi, and Karnal, all in the Delhi division. The unusual increase in the fever mortality of the Hissar district during the first quarter of 1902 is ascribed by the Civil Surgeon to cerebro-spinal fever of a very severe and fatal type which prevailed in an epidemic form during that period. The disease also prevailed during the first half of the year in the city of Delhi, and perhaps also in the Rawalpindi district. Trial measures for the prevention of malaria by the destruction of mosquitoes were carried out in Gujranwala and Gujrat, but with very little success owing chiefly to the outbreaks of plague in both the towns. In the North-West Frontier Province the death-rate from fevers was 4·69 per 1,000 higher than in 1901. In the Central Provinces the mortality from this cause fell slightly. The Sanitary Commissioner considers it probable that the large majority of the deaths ascribed to fever were due to fevers of malarial origin. Systematic operations against mosquitoes, based on the recommendations of the conference on malaria held at Nagpur in January, were carried out in certain selected towns. In Berar the fever death-rate was slightly reduced. Some municipalities were selected as areas for experiment in the destruction of mosquitoes, but the provincial Sanitary Commissioner does not anticipate that much will be done in this direction as the finances of the municipalities are so taxed by the strain of plague expenditure. The mortality from fevers in Lower Burma was slightly in excess of that of 1901, but considerably lower than the mean ratio for the previous five years. The provincial Sanitary Commissioner remarks that the figures probably include a considerable number of deaths from dengue which was prevalent throughout the province from April to September; but dengue, though very contagious, is by no means a fatal disease, and the deaths from this cause would hardly be likely to appreciably affect the total fever death-rate. In the Madras Presidency the mortality ratio from fevers was slightly lower during 1902 than during 1901. The mortality in the town of Madras decreased from 18·3 to 14·7 per 1,000, but this town still has one of the highest fever rates in urban areas in the presidency and compares very unfavourably with other large towns in India, such as Calcutta, where the fever death-rate during 1902 was only 6·59 per 1,000, and Bombay, where it was only 6·30. The Sanitary Commissioner of Madras is apparently unable to account for this high rate in Madras town, and remarks that, in the absence of registration supported by medical diagnosis, it is, of course, impossible to ascertain what proportion of fevers in Madras town are due to malaria or to typhoid and other possibly

unnamed fevers. Dengue was prevalent in several localities of the presidency, but it did not add appreciably to the mortality. In Bombay the fever death-rate declined as compared with 1901, but high ratios were recorded in Ahmedabad and five other collectorates, apparently due, in the provincial Sanitary Commissioner's opinion, to a certain extent to famine causes. Although a high total death-rate may be the result of famine, this cause does not necessarily produce a high fever death-rate, and it is evident from a consideration of the statistics supplied by the Sanitary Commissioner that in some at least of those collectorates the high fever death-rate was simply due to the fact that nearly all the deaths which occurred were recorded under this heading.

Statement showing the deaths from Fevers registered in British Provinces by Months during the year 1902.

PROVINCE.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL.	RATIO OF DEATHS PER 1,000 OF POPULATION.	
													1902.	1902.	1901.
Bengal	134,495	114,215	136,715	149,076	123,715	123,003	121,408	117,150	155,351	149,392	177,740	216,661	1,721,921	23·13	21·72
Assam	6,212	5,404	5,590	6,173	7,294	6,672	6,566	5,827	6,468	7,222	7,161	7,090	†77,679	14·72	15·86
United Provinces	94,747	78,431	86,375	98,752	108,282	97,325	76,071	82,760	106,214	113,232	117,002	109,911	1,169,102	24·51	23·46
Punjab	51,124	42,960	43,581	38,496	39,832	30,036	25,673	30,002	31,928	45,105	47,887	46,728	473,352	23·54	25·26
North-West Frontier Province	3,257	3,395	3,450	2,836	3,053	2,652	2,339	2,862	2,512	3,132	4,124	4,051	37,663	18·92	14·23
Central Provinces*	9,404	8,403	9,368	10,045	10,440	9,577	7,093	9,215	12,089	14,656	16,100	13,097	129,487	14·51	14·66
Berar	2,808	2,860	3,112	3,252	2,859	1,795	1,738	3,134	4,231	4,462	3,895	3,108	37,354	13·73	13·93
Lower Burma	4,521	3,470	3,385	3,395	3,275	3,827	4,761	4,938	4,155	4,051	4,611	4,773	49,162	8·86	8·65
Upper „	1,922	1,254	1,601	1,742	1,591	1,420	1,499	1,479	1,268	1,386	1,654	1,574	18,393	‡	‡
Madras Presidency	27,550	21,582	19,751	18,623	20,628	20,072	21,281	23,039	25,088	26,982	26,075	27,008	277,689	7·65	7·90
Bombay „	26,506	24,499	26,335	21,526	17,010	15,109	16,828	18,292	20,072	23,490	32,012	29,166	270,845	14·66	15·80
Ajmer-Merwara	1,290	1,287	1,800	1,626	1,202	657	624	710	781	917	952	942	12,788	26·81	27·45
Coorg	315	321	363	315	362	448	422	391	352	291	253	283	4,116	22·79	28·69
Total	364,161	308,081	341,429	355,857	342,543	312,593	286,303	299,799	370,609	394,318	439,466	464,592	4,279,551	19·17	18·73

* Excluding Chhatisgarh Zamindaris. † Includes 6,333 deaths from Kala Azar. ‡ Not available.

Sale of Quinine.—In Bengal there was a considerable increase in the number of five-grain pice packets of quinine sold during 1902, 34,114 parcels each containing 102 five-grain packets being disposed of as compared with 30,593 parcels during 1901. This increase is considered to have been due to the much greater prevalence of fever during 1902 than during 1901.

In Assam the sale of quinine decreased all over the province probably because the year was less malarious than usual. In the whole province 1,434 parcels were sold as compared with 1,717 in 1901.*

In the Central Provinces the sale of quinine showed a steady increase, 2,681 parcels each containing 102 five-grain packets being sold during 1902 as compared with 2,050 in 1901. In the year 1901 all sales were effected through the agency of post offices, but during 1902 sales were also made through the agencies of schoolmasters, stamp-vendors, and *patwaris*.

The number of five-grain packets of quinine sold during 1902 in the United Provinces was 224,999. Of these 157,820 packets were sold at post offices, 24,093 by vaccinators, and 43,086 by landlords. Quinine was sold at post offices in all districts except Almora and Etah, but it was sold by vaccinators only in 22 and by landlords in eight districts.

It is said that quinine was gratuitously distributed in 13 districts of the Punjab, but the only references to the sale of quinine contained in the provincial Sanitary Commissioner's report are to the effect that Civil Surgeons have no concern with the sale of pice packets of quinine at post offices, and that since December the work of selling quinine to post offices for sale to the public has been transferred to the Lahore Central Jail.

* *i.e.*, 146,268 and 175,134 five-grain packets.

In Burma the sale of quinine through the post office, by private vendors, and by vaccinators, was steadily continued, and 179,708 five-grain packets at three pies each were sold during 1902, as compared with 158,385 during 1901.

Details are wanting regarding quinine sales in the North-West Frontier Province, Madras, Bombay, and Berar.

Dysentery and Diarrhœa.—The mortality ratio on account of dysentery and diarrhœa fell from 2·45 per 1,000 in 1900 and 1·11 per 1,000 in 1901 to the comparatively low figure of 1·06 per 1,000 in 1902. The ratio was also considerably below the mean ratio for the previous five years. The total number of deaths attributed to dysentery and diarrhœa during 1902 was 235,089 as compared with 247,054 during 1901. A decreased mortality occurred in all months of the year except April, May, June, and November. In Bengal the largest number of deaths occurred as usual in December, and as usual the disease prevailed with much greater severity in urban than in rural areas. The highest mortality was recorded in the district of Howrah (4·88 per 1,000), the districts of Puri, Cuttack, Calcutta, Patna, and Darjeeling coming next with ratios ranging from 3·87 to 3·07 per 1,000. The mortality ratios for Goalpara, Darrang, Sibsagar, and Lakhimpur in the Assam valley show the same large differences ranging from ·19 per 1,000 in Goalpara to 4·55 per 1,000 in Lakhimpur as have been noted in previous years; and investigation has not yet succeeded in suggesting a satisfactory explanation. The main factor which influences the results is the much higher death-rate among tea-garden coolies than among the rest of the population. The medical officer at Cachar considers the increased mortality in tea gardens to be due to the inclusion of deaths from advanced cases of beri-beri (so-called) along with deaths from diarrhœa, and the medical officer at Lakhimpur thinks that in tea gardens deaths from anchylostomiasis are frequently wrongly returned under the head of dysentery and diarrhœa on account of the similarity of symptoms in these diseases. The true explanation may possibly be that given by the medical officer at Darrang, who says that in tea gardens febrifuges are largely employed, and that deaths from "fever" are usually returned under the heading of "bowel disease," its common terminable condition; for the medical officer at Lakhimpur gives a table which shows that while the tea-garden coolie, from the statistical point of view, suffers about three times as much from bowel complaints as the general population, he suffers about three times as little from fevers, and the total loss from both complaints among both communities was about the same in 1902, viz., 14·47 per 1,000 for tea-garden coolies and 14·46 for others. In the United Provinces the death-rate from dysentery and diarrhœa was practically the same in 1902 as in the previous year. In the Punjab the

Statement showing the deaths from Dysentery and Diarrhœa registered in British Provinces by Months during the year 1902.

Province.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total. 1902.	Ratio of deaths per 1,000 of population 1902.	1901.
Bengal	4,814	4,261	4,757	5,251	4,256	4,062	4,114	4,154	5,340	4,527	4,985	6,474	56,995	0·76	0·80
Assam	702	625	673	770	1,018	967	965	1,057	1,023	1,163	1,176	1,074	11,213	2·13	2·19
United Provinces	1,892	1,397	1,817	2,559	2,875	2,642	2,084	2,418	2,730	2,666	2,478	2,357	27,915	0·53	0·57
Punjab	1,075	644	807	1,026	1,185	976	1,054	1,450	1,564	1,601	1,404	1,338	14,124	0·70	0·73
North-West Frontier Province	28	22	28	43	37	31	68	96	75	80	67	72	647	0·33	0·19
Central Provinces*	634	584	540	589	572	551	644	1,132	1,439	1,202	1,067	726	9,680	1·09	1·20
Berar	718	603	690	744	698	446	600	1,216	1,669	1,703	1,299	1,022	11,408	4·19	4·36
Lower Burma	635	483	477	389	513	763	1,055	904	658	399	409	528	7,213	1·30	1·47
Upper „	26	36	39	62	54	77	118	92	54	41	28	34	661	†	†
Madras Presidency	4,167	2,819	2,320	2,288	2,425	2,336	2,842	3,353	3,386	3,438	3,518	3,741	36,633	1·01	1·13
Bombay „	4,045	3,497	4,038	4,350	3,990	3,867	5,220	6,501	6,449	5,810	5,535	5,380	58,682	3·18	3·26
Ajmer-Merwara	40	19	56	69	50	33	39	24	30	36	37	40	473	0·99	1·40
Coorg	5	6	9	11	13	11	17	10	11	2	4	7	106	0·59	1·20
Total	18,781	14,996	16,251	18,151	17,686	16,762	18,820	22,407	24,428	22,668	22,007	22,793	235,750	1·06	1·11

* Excluding Chhatisgarh Zamindaris. † Not available.

urban death-rate from dysentery and diarrhœa was four times as high as in the rural circles. The Sanitary Commissioner says that dysentery and diarrhœa and fever rates rise concurrently, and that in all except one of the towns where excessive death-rates from dysentery and diarrhœa were recorded, malarial fevers were very prevalent during the year. In the Central Provinces the death-rate from dysentery and diarrhœa was lower than in 1901, though in 10 districts a slightly higher rate of mortality was recorded. In the town of Nagpur the high mortality among children from bowel diseases during the rainy season was attributed to deficient rainfall and long breaks in the rains with corresponding increase in temperature. In Madras the death ratio from dysentery and diarrhœa was 1·01 per 1,000 as compared with 1·13 per 1,000 in 1901. In the town of Conjeeveram, which is supposed to have a good public water supply, one of the highest death ratios from this cause was recorded. In Berar, Bombay, Ajmer-Merwara, and Coorg the death-rates from bowel complaints were all lower than those of 1901.

Vaccination.

Vaccination in India,—The aggregate number of operations performed in 1902-1903 was 8,431,564, which is 395,120 more than in the previous year, and 557,172 more than in 1900-1901.

In all the provinces, except the Punjab, an increase was recorded in the numbers of operations performed ; and in the Punjab the decrease amounted to only 600 operations. Work progressed most in Bengal, the United Provinces, and Bombay ; and, in the Central Provinces, Assam, Burma, Berar and the North-West Frontier Province, considerably more operations were performed than in the previous year.

The number of primary operations performed during the year was 7,791,858, or 433,114 more than in 1901-1902, but the number of re-vaccinations fell from 677,706 to 639,706, a decrease of 37,994. In the Punjab the decrease in the number of re-vaccinations amounted to 72,105, and there was also a considerable falling off in the number of re-vaccinations performed in Berar, from 38,122 in 1901-1902, to 23,505 in 1902-1903.

The average degree of success obtained in the country generally was better than in either of the two preceding years. In primary operations and in re-vaccinations, respectively, the percentages of success in 1900-1901 were 94·5, and 64·4 in 1901-1902 they were 94·97 and 65·5, and in the year under review 95·10 and 68·20. As in the previous year the highest percentages of success in primary operations were recorded in Ajmer-Merwara (99·18) and in Bengal (98·11) ; the lowest was recorded in Burma (86·03) and Madras (89·08). The percentages of success in re-vaccination ranged from 88·41 in the United Provinces, 86·36 in Ajmer-Merwara, and 85·14 in the Central Provinces, to 48·15 in Burma and 16·50 in Berar.

At dispensaries 208,733 operations were performed as compared with 210,277 in 1901-1902. In six provinces an increase in the number of operations performed was recorded, and in four a decrease. In two provinces, Berar and Ajmer-Merwara, no vaccination work is done at dispensaries. In Bengal the number of dispensary vaccinations decreased by 12,830, but it was still the province in which by far the largest number of operations were performed, Assam, the Central Provinces, and Madras coming next in order. In the Punjab only 206 operations were performed at dispensaries.

The average proportion of the population successfully vaccinated during the year was 33·14 per 1,000 as compared with 31·36 per 1,000 in 1901-1902. An increase in the proportion protected was recorded in all Provinces, Berar coming first with an increase of 12·8 per 1,000, the North-West Frontier Province and Coorg following next with increases of 9·93 per 1,000 and 9·27 per 1,000 respectively. The proportion of successful vaccinations per 1,000 of population was highest in Coorg, Assam, and Berar, and lowest in Bombay.

On the supposition that 40 children were born for every 1,000 of the population, 39·15 per cent. of them were protected by vaccination during the year as compared with 33·41 per cent. in the previous year, the percentages varying between 91·76 in Berar, 63·58 in the Central Provinces, 57·40 in Ajmer-Merwara, and 13·61 in Coorg.

The mean number of operations performed by each vaccinator in the year ranged from 3,527 in Berar and 3,365 in the North-West Frontier Province, to 999 in Assam and 866 in Ajmer-Merwara.

The average small-pox mortality was ·51 per 1,000 as compared with ·40 per 1,000 in 1901-1902. The death-rates ranged in the provinces from 1·26 per 1,000 in Assam, where there were 6,673 deaths, ·77 in Bengal, where there were 57,430 deaths, and ·7 in Madras where there were 24,967 deaths, to ·01 in Ajmer-Merwara, where only 3 deaths from small-pox were recorded.

Total Primary and Re-vaccinations, successful cases among the children, and cost of the Special Vaccination Department, during the official year 1902–03.

Province.	Number of Persons vaccinated by the Special and Dispensary Staffs combined.		Percentage of Successful Cases to Total Operations.		Number of Children successfully vaccinated by the Special and Dispensary Staffs combined.		Average number of operations performed by each vaccinator of the Special Staff.	Total Cost of the Special Department.
	Primary.	Re-vaccinations.	Primary.	Re-vaccinations.	Under One Year.	One to Six Years.		
								Rs.
Bengal	2,592,177	189,795	98·11	68·07	894,791	1,462,913	1,001	1,99,448
Assam	291,332	12,789	97·90	77·81	69,787	188,423	999	24,955
United Provinces of Agra and Oudh	1,562,070	103,183	97·90	88·41	942,065	486,086	1,840	1,36,196
Punjab	582,626	84,918	95·36	61·04	461,050	87,915	1,714	93,700
North-West Frontier Province	82,352	7,941	93·54	69·84	43,951	23,744	3,365	11,644
Central Provinces	398,065	65,986	97·13	85·14	301,934	71,737	1,598	47,434
Berar	117,559	23,505	96·8	16·5	101,099	11,339	3,527	18,037
Madras Presidency	1,250,762	81,447	89·08	68·91	382,079	577,222	1,552	2,58,750
Coorg	9,594	1,813	94·78	80·42	983	5,448	1,229	2,768
Bombay Presidency	537,744	41,141	92·92	55·72	419,373	73,185	1,354	2,84,488
Burma	354,629	27,144	86·93	48·15	79,582	169,959	1,739	85,829
Ajmer-Merwara	12,948	44	99·18	86·36	10,950	1,427	866	2,507
TOTAL	7,791,858	639,706	95·10	68·20	3,707,644	3,160,398	1,460	11,65,756

Vaccination operations performed by the Special and Dispensary Establishments separately, deaths from Small-pox, etc., during the official year 1902–03.

Province.	Population.	Number of Persons vaccinated (Primary and Re-vaccinations combined).			Ratio of successful vaccinations per 1,000 of population.	Percentage of annual estimated births at 40 per 1,000 of population successfully vaccinated.	Deaths from Small-pox*.	
		By Special Department.	By Dispensary Staff.	Total.			Number.	Ratio per 1,000 of population.
Bengal	74,764,424	2,649,141	132,831	2,781,972	37·21	29·92	57,430	0·77
Assam	6,126,343	281,524	22,597	304,121	48·18	28·48	6,673	1·26
United Provinces of Agra and Oudh	47,960,667	1,664,783	470	1,665,253	33·17	49·11	4,976	0·10
Punjab	20,295,036	667,338	206	667,544	29·93	56·79	11,629	0·58
North-West Frontier Province	2,072,326	84,126	6,167	90,293	39·85	53·02	1,081	0·54
Central Provinces	11,873,029	446,523	17,528	464,051	37·30	63·58	4,394	0·45
Berar	2,754,016	141,064	—	141,064	42·7	91·76	327	0·12
Madras Presidency	38,227,818	1,317,365	14,844	1,332,209	30·61	24·99	24,967	0·7
Coorg	180,607	11,062	345	11,407	58·42	13·61	19	0·11
Bombay Presidency	21,539,199	576,403	2,482	578,885	24·26	48·68	2,189	0·12
Burma	10,477,508	370,510	11,263	381,773	30·67	18·99	1,915	0·22
Ajmer-Merwara	476,912	12,992	—	12,992	27·01	57·40	3	0·01
TOTAL	236,747,385	8,222,831	208,733	8,431,564	33·14	39·15	115,603	0·51

* For the calendar year.

The aggregate cost of the Department was Rs. 11,65,756, or Rs. 33,499 more than in 1901-1902. The average cost of each successful case works out to 2 annas and 5 pies, against 2 annas and 6 pies in the preceding year. The greatest cost of each successful case was 8 annas and 9 pies in Bombay, Burma coming next with a cost of 4 annas and 5 pies, and Coorg next with 4 annas and 3 pies. In Bengal the cost of each successful case was only 1 anna and 2 pies.

Experiments regarding the preservation of calf lymph.—During 1902 and 1903, experiments were carried on in the Punjab by Captain W. F. Harvey, I.M.S., for the purpose of determining the relative efficacy and suitability of vaselinated and glycerinated vaccine lymphs derived from the buffalo calf.* Many of the experiments depending upon the results obtained by using the two preparations as vaccines were rendered of little value by conditions that had not been foreseen ; but it was found that, with properly prepared glycerinated lymph and careful vaccination, success at the rate of 99·81 per cent. was obtained in 5,166 cases of which 4,324 were inspected by Captain Harvey personally. Glycerinated lymph presents the following advantages over vaselinated lymph.

Glycerine is easier to mix with vaccine pulp than is vaseline, and, in consequence, the results of vaccination with glycerinated lymph are more likely to be uniform.

Glycerinated lymph rids itself of extraneous micro-organisms, vaselinated lymph does not. Glycerinated lymph is fit for use after a fortnight's storage ; and after a month's storage, the only organisms remaining were spore bearing bacilli and a large micrococcus, both of which can, it appears, be excluded if due care is taken of the vaccinifer.

Glycerinated lymph gives rise to a characteristic scab, whereas the scab which follows the use of vaselinated lymph, owing to the inflammation which it sets up, is usually composed of inspissated pus.

Glycerinated lymph appears to be more capable of resisting the effects of a high temperature than vaselinated lymph.

Captain Harvey found also that there was practically no difference in the results obtained by vaccinating with a mixture consisting of 1 part of vaccine pulp diluted with 2 parts of 50 per cent. glycerine, and with a mixture of 1 part of pulp diluted with 4 parts of 50 per cent. glycerine ; the use of the latter is, of course, the more economical.

Bengal.—The total number of operations performed in Bengal during the year 1902-1903 was 2,781,972, as compared with 2,662,826, in the previous year, and 2,346,311 in 1900-1901. Primary cases numbered 2,592,177 and re-vaccinations 189,795, the corresponding figures in the previous year being 2,529,778 and 133,048.

In both classes of work, therefore, a larger number of operations were performed. The success attending the work was also somewhat better, 98·11 per cent. of the primary cases and 68·07 per cent. of the re-vaccinations proving successful, while in the previous year the rates per cent. were 98·01 and 67·07 respectively.

The aggregate increase of 119,146 operations was not equally distributed over the whole province : 32 districts show an increase and 17 districts a decrease as compared with the previous year. Striking increases were recorded in the districts of Puri, Sonthal Parganas, and Midnapore. In Puri 35,266 more operations were performed than in the previous year, and in the two other districts mentioned the numbers were increased by over 23,000 cases. The increase in Puri is said to have been due to the employment of a larger number of vaccinators by the District Board, and in the other two districts to the prevalence of small-pox in them, which disposed the people to resort to vaccination. A remarkable decrease occurred in the number of operations performed in the district of Mymensingh, the number being 50,999 less than in the previous year. This decrease is attributed to the fact that a very large number of persons were vaccinated in the previous year on account of the epidemic of small-pox which prevailed at that time, while it is believed that the number of operations in the previous year were overstated. In other districts where decreases occurred, the causes assigned were generally the prevalence of malaria or cholera.

During the year under review it is estimated that 36·05 per cent. of the infants under one year available in the province for vaccination were protected, as compared with 32·06 per cent. in the previous year ; while in the municipalities the percentage of protected infants was 72·3. This figure compares favourably with those of recent years, but in some municipalities the rate of infant vaccination is still very low, notably in Calcutta where only 2,626 infants under one year of age were successfully vaccinated out of 7,976 who were available.

*A short account of a similar investigation made by Dr. Srinivasa Rao of Mysore will be found in the *Comptes Rendus* of the Thirteenth International Medical Congress—Section de Bactériologie et Parasitologie, page 96

Small-pox again prevailed in epidemic form during 1902, the total number of deaths amounting to 57,430 and the ratio per 1,000 of population to ·77 as compared with a ratio of ·50 per 1,000 in the previous year.

During the year 214,764 primary vaccinations were performed with calf lymph, 399,205 with lanoline lymph, and 1,978,208 by the arm-to-arm process, the percentages of success by each of these methods being 98·13, 96·75, and 98·38, respectively.

The Nepal Durbar and the Sikkim State received, respectively, 555 and 705 grains of lymph during the year. That supplied to the Nepal Durbar is reported to have given very good results.

With regard to the lymph supply of the province it has been arranged that the Calcutta vaccine depôt will no longer supply lymph to the Calcutta Corporation, and as this sets free a larger supply for the districts, the local authorities have decided that there is no immediate necessity for establishing vaccine depôts in Orissa or at Pusa.

Assam.—The operations during the year numbered altogether 304,121, of which 291,332 were primary operations and 12,789 re-vaccinations. In the previous year the total amounted to 280,827, the number of primary operations being 271,415 and the number of re-vaccinations 9,412, so that the figures for the year under review show a satisfactory increase of both classes of work. The recorded percentage of success in primary operations was 97·90 against 97·48 in the previous year, but in re-vaccinations the percentage of success fell from 81·09 to 77·81.

Excluding the hill districts where births are not registered, there were 143,769 infants under one year of age available for vaccination during the year ; among these 46,853 vaccination operations were actually performed, giving a protected rate of 32·59 per cent. for the plains districts as compared with 32·60 per cent. in the previous year. In the towns, where the Compulsory Vaccination Act is in force, more than 80 per cent. of the children available for vaccination were protected.

The amount and quality of the work done at the Animal Vaccine Depôt at Shillong was very satisfactory. The total number of tubes loaded with vaccine was 401,870, as compared with 395,317 in the previous year, and 387,557 in 1900-1901. The quality of the lymph was generally excellent throughout the year, although unfavourable reports were received from the Sylhet and Sibsagar districts regarding one supply. The vesicles of the calf from which this supply was taken were stated to have appeared to be as good as usual, and the reason why the lymph proved bad was unknown. A few experiments regarding the length of time during which lymph preserved in lanoline remains efficacious are reported by the provincial Sanitary Commissioner. The experiments showed that the lymph as manufactured in Assam, becomes ineffective after having been kept for a month or at the outside six weeks.

Inoculation still continues to find favour with the inhabitants of some parts of the province, especially with those of the Cachar and Sylhet districts.

United Provinces.—Including those at dispensaries, the total number of operations performed in the United Provinces in 1902-1903 was 1,665,253, as compared with 1,580,19 in the previous year. Of this number 1,562,070 were primary cases and 103,183 re-vaccinations, the percentages of success being 97·90 and 88·41, respectively, as compared with 96·02 and 81·55 in the previous year. It is satisfactory to note that despite the greater prevalence of plague in this province during the year under review, the figures show an improvement under all heads as compared with those of previous years. Vaccination in municipalities shows a decrease of 5,365 successful primary operations as compared with 1900-1901, and a proportion of 34·74 persons successfully vaccinated per 1,000 of population as compared with a proportion of 35·89 in the preceding year. In some of the worst protected municipalities, such as Cawnpore, Fyzabad and Gorakhpur, the low rate was attributed to the prevalence of plague.

Of 95,646 infants under one year of age estimated as available for vaccination in the municipalities, 87,725 were successfully operated upon.

Bovine lymph depôts were maintained, as usual, at Lucknow, Bahraich, and Allahabad. The total number of primary operations performed with pure calf lymph was 21,065, the percentage of success being 98·73. In 4,408 operations performed with lanoline lymph the percentage of success was 96·88.

The construction of the buildings for the central calf lymph depôt at Patwa Dangar has been commenced, and it is expected that the depôt will soon be in working order.

Punjab.—The total number of operations performed in the Punjab during 1902-1903 was 667,544 as compared with 668,144 in 1901-1902. The number of primary operations

rose from 511,121 to 582,626, while the number of re-vaccinations fell from 157,023 in 1901-1902 to 84,918 in the year under review. The increase in the number of primary vaccinations was due to the resumption of work in the plains districts where, in the previous year, it had been thought desirable to restrict vaccination operations on account of the prevalence of plague. The fear that anti-plague inoculation is to be carried out under the guise of vaccination appears, however, to be felt more by the inhabitants of districts where there is little or no plague than by those of districts where the disease is rife, and the large decrease in the number of re-vaccinations is attributed mainly to the fact that the inhabitants of the Kangra district and Simla Hill States, fearing that they would be subjected not to vaccination but to anti-plague inoculation, refused to have any operations performed.

The percentages of success as compared with those of the previous year rose from 93·92 to 95·36 in primary cases, and from 58·47 to 61·04 in re-vaccinations.

The numbers of primary operations and re-vaccinations performed in the Native State of Patiala were 45,088 and 9,707 ; in Kapurthala 6,207 and 39 ; in Faridkot 4,289 and 1,632 ; and in Nabha 866 and 1. The percentages of success in primary operations ranged from 98·63 in Patiala, to 88·68 in Nabha.

The number of children available for vaccination in towns was computed to be 59,365 ; of these 37,103, or 62·50 per cent. were protected. The Vaccination Act was not extended to any new town during the year, and in Delhi, Jullundur and some other towns a very large number of children remained unprotected. The prevalence of plague in many of the towns doubtless interfered to some extent with the work, but the provincial Sanitary Commissioner is of opinion that the chief causes of the slow progress of vaccination in the towns are the apathy of the people and the want of interest shown by members of municipal committees.

North-West Frontier Province.—There was a marked improvement in the primary vaccination work carried out in this province during 1902–1903 as compared with that of the previous year ; a total of 82,352 primary operations being performed against 63,321 in 1901–1902. The number of re-vaccinations increased from 7,672 to 7,941. The percentage of success in primary cases rose from 91·03 to 93·54, but in re-vaccinations it fell from 75·18 to 69·84.

Of the 10 municipal towns in the province the Vaccination Act is in force in two only, viz., Dera Ismail Khan and Bannu. In Peshawar city out of a total of 1,688 children under one year of age available for vaccination only 942, or 55·81 per cent. were successfully operated upon. The extension of the Act to Peshawar city is, however, under consideration.

Both animal and preserved vaseline lymph were used, the former showing a percentage of success in primary cases of 93·4, and in re-vaccinations of 70·1, and the latter success at the rates of 89·5 and 74·0 per cent., respectively.

In the Kohat district efforts to convert inoculators to the principles of vaccination have not been successful, but in the Mardan sub-division several inoculators were induced to come in and learn how to vaccinate.

Central Provinces.—The figures relating to vaccination in the Central Provinces include the work of the Feudatory States vaccination establishment and all the dispensary operations in the province. In regard to the Feudatory States in the Chattisgarh Division, however, the figures given for the year under review relate to the work of nine months only, viz., from the first of April to the 31st of December, 1902. The total number of operations performed by all agencies during the year 1902–1903 was 464,051, of which 398,065 were primary cases and 65,986 re-vaccinations, the percentage of success in primary operations being 97·13, and in re-vaccinations 85·14. In comparing the results of vaccination during the year under review with those of the previous year the figures for Feudatory States must, for the reasons given above, be excluded. Excluding also the figures relating to vaccination operations performed in dispensaries, there were 339,139 primary operations in British districts and 44,390 re-vaccinations during 1902–03 as compared with 269,270 and 53,409, respectively, during the previous year. While, therefore, the number of primary operations increased by 69,869, the number of re-vaccinations diminished by 9,019. The percentage of success in primary cases rose from 96·87 to 97·39, and in re-vaccinations from 83·56 to 85·14.

In all the districts except two, an increase in the number of primary vaccinations was recorded, a result which is attributed mainly to the very high birth-rate of 1902 combined with comparatively low infant mortality. Commendable activity was also displayed by the vaccination staff in some districts.

Of 357,679 children under one year available for vaccination in British territory during the year, 283,891 or 79·37 per cent. were successfully vaccinated. Low percentages were recorded in the districts of Chanda, Nagpur, and Jubbulpore, the poor results in the last two districts being attributed partly to the prevalence of plague. The provincial Sanitary Commissioner remarks, however, that plague was present in other districts without a corresponding decline in vaccination work.

Re-vaccination is said to be generally unpopular, and in the Damoh district it was interfered with by a rumour that it was really anti-plague inoculation. But the rates in different districts vary greatly, and it appears evident that in some districts sufficient attention is not paid to this class of work.

The Vaccination Act was not extended to any additional town during the year, and only about 65 per cent. of the available children under one year of age in the towns were successfully vaccinated, as compared with 73·40 per cent. in the previous year. Vaccination of young children is very defective in many municipal towns to which the Act has been extended, but it is said that improvement in this respect is anticipated during the next year.

About one-half of the operations in British territory were performed with fresh calf lymph, and the percentage of success was somewhat higher than in the previous year, being 96·09 against 95·63. The results obtained with glycerinated lymph were also more satisfactory than in 1901-1902, the percentage of successful cases being 95·25 as compared with 90·96 in that year. It is noted that while with the lymph prepared at Bhandara the percentage of success in primary vaccinations was 99·81, with that prepared at Seoni, failure resulted in three-fourths of the cases.

Berar.—The total number of operations performed during 1902–1903 in Berar was 141,064, or 20,646 more than in the previous year. Of this number 117,559 were primary cases and 23,505 re-vaccinations, which shows an increase of 35,263 primary operations and a decrease of 14,617 re-vaccinations, as compared with the previous year's work. The percentages of success were 96·8 in primary cases and 16·5 in re-vaccinations, the corresponding figures for the previous year being 96·6 and 18·3.

Vaccination in municipal towns is compulsory and the number of available infants under one year of age successfully vaccinated during the year under review compares somewhat unfavourably with the number so protected in the previous year, the percentages being 82·6 and 93·9 respectively. In three of the towns the decrease in the number of infants vaccinated is attributed to severe outbreaks of plague.

As in the previous year lanolinated lymph was used exclusively, and as the department was able to work below the sanctioned scale of establishment, the cost of each successful operation was nearly one anna less than in that year.

Madras.—An increase in the total number of operations performed by all agencies in the Presidency was again recorded during 1902-1903, the number being 1,332,209 as compared with 1,325,106 during 1901-1902. The increase occurred entirely in local fund areas ; in the municipalities there was a decrease of 11,210 cases, which is variously accounted for by the prevalence of plague, the disappearance of small-pox, the neglect of re-vaccination and paucity of cases available.

In six districts, against nine in the previous year, a decrease in the number of operations performed was recorded, the main reasons assigned being generally, as in 1901-1902, insufficiency of staff, the presence of plague, and insufficiency of lymph.

The total number of re-vaccinations fell from 89,910 to 81,447.

The percentages of success in primary cases fell from 89·41 to 89·08, and in re-vaccinations from 69·00 to 68·91.

In municipalities an average of 67 per cent. of the available children were successfully vaccinated as compared with 66 per cent. in 1901-1902, but in only 38 towns was the ratio of 75 per cent. or more, against 47 in the previous year.

A vaccine institute is about to be opened at Guindy.

Coorg.—Small-pox was less prevalent in Coorg during 1902-1903 than in the previous year, but the total number of operations performed rose from 9,772 to 11,407, of which 9,594 were primary cases, and 1,813 re-vaccinations, as compared with 8,416 and 1,356, respectively, in the previous year. At dispensaries 345 persons were vaccinated, against 320 in 1901-1902.

The percentages of success were 94·8 and 80·4 in primary cases and re-vaccinations, respectively, the corresponding figures for 1901-1902 being 93·5 and 74·2.

The average cost of each successful case of vaccination in the whole province was 4 annas and 3 pies, while in one municipality it was 7 annas and 10 pies, and in another 14 annas and 5 pies.

Bombay.—There were 537,744 persons primarily vaccinated and 41,141 re-vaccinated in the Presidency during 1902-1903 against 471,233 and 50,473, respectively, during the previous year—an increase of 66,511 primary cases and a decrease of 9,332 re-vaccinations. In the total number or operations there was an increase of 57,178.

In primary vaccination there was a decrease in the Southern and Sind Registration Districts, and in re-vaccination a decrease in all the districts except the Presidency Circle. This is attributed in the Southern district mainly to the presence of plague, and in the Sind district to a large amount of sickness.

The percentage of success rose in primary vaccination from 91·9 to 92·9, but fell in re-vaccination from 59·9 to 55·7. The percentage of cases in which the results were unknown rose from 6·71 in 1901-1902 to 7·80 in the year under review.

The number of infants successfully vaccinated in the Presidency (exclusive of Native States and Aden) was 364,513, or 71·85 per cent. of the available number.

The quality of lymph in use throughout the year was reported to be good. Both human and bovine lymph were used. About nine-tenths of the operations were performed with the former, the average percentage of success attained being 91·5. Animal lymph gave an average of 82·6 per cent. of success and was used in about one-tenth of the operations. With lanoline paste 5,525 operations were performed with a success of 84·18 per cent.

Burma.—The total number of operations performed during the year under review, including those performed at dispensaries, was 381,773, of which 354,629 were primary and 27,144 re-vaccinations ; the corresponding figures for 1901-1902 being 360,224, 333,657, and 26,567, respectively. Although the number of operations performed was greater than in the previous year, the ratio of success was lower, only 86·9 per cent. of primary cases and 48·15 per cent. of re-vaccinations being successful, as compared with 90·1 per cent. and 51·0 per cent., respectively, in 1901-1902.

The increase in the number of vaccinations occurred entirely in Upper Burma. The falling off in Lower Burma was ascribed to the predilection of the people for inoculation, to the indifferent class of men who seek employment as vaccinators, and to the closer supervision of their work.

The reason for the lower rate of success in operations is not stated, and the quality of the lymph supplied from the new vaccine depôt at Meiktila was said to be on the whole satisfactory. The results reported by Civil Surgeons were, however, not always in agreement, and a supply which was reported to have given successful results in 92 per cent. of cases in one place was said to have totally failed in all cases in another.

The Vaccination Act is in force in all municipal towns, but it is said that in Lower Burma the people fully understand that vaccination is not compulsory outside municipal limits, nor inoculation illegal, so that villages which willingly submitted to vaccination in past years now hold aloof altogether on one pretext or another.

Ajmer-Merwara.—There was a distinct improvement in the vaccination work carried out in this small province during 1902-1903 as compared with the previous year. The total number of operations performed during the year under review was 12,992, as compared with 10,841 in 1901-1902. Of this number, 12,948 were primary cases and 44 re-vaccinations, the corresponding figures for the previous year being 10,831 and 10, respectively.

Civil Sanitary Works.

Bengal.—Excluding Calcutta and including two new municipalities at Tallygang and Giridih, there were 157 municipalities in Bengal during 1901-02, as compared with 155 during the preceding year; and their total income, including an opening balance of £40,330, amounted to £344,160, of which 43·41 per cent. was spent on original and recurring sanitary works, 9·89 per cent. on roads, 5·58 per cent. on public safety, and 29·32 per cent. on all other requirements, the corresponding figures for 1900-01 having been 44·48, 9·14, 5·29, and 28·90, respectively.

The total expenditure on sanitary works amounted to £150,300, or 43·41 per cent. of income. The expenditure on the principal items was, roundly, 12½ lakhs on conservancy, 2½ lakhs on water-supply, and 1¾ lakhs on drainage. The expenditure under the head of conservancy shows an increase of £5,340, while that under water-supply and drainage decreased by £130 and £1,956, respectively. Only ten municipalities, or three less than in the preceding year, spent over 10 per cent. of their income on original sanitary works, 17 against 19 spent between 5 and 10 per cent., 74 against 77 spent below 5 per cent., while 56 against 46 spent nothing on this account.

The total cost of various new works carried out by municipalities, district boards, Government and private individuals, either completed or in progress, amounted in towns to £21,910, against £28,040 in the previous year, and in rural areas to £48,150, against £40,350. No new work of first class importance was either commenced or finished during the year.

Only one meeting of the Sanitary Board was held during the year. The principal subjects discussed at this meeting were the Howrah drainage scheme, the Gaya conservancy tramway scheme, and the septic-tank system of sewage disposal. The preliminary estimates for a drainage scheme for the Bihar Municipality were in course of preparation, but no detailed estimates for any project were prepared in the Board's office during the year.

Plans and estimates were considered and opinions given on twelve important water-works and drainage schemes, among them the extension of the Maniktollah water-supply scheme, which after revision by the Sanitary Engineer estimated to cost £12,270, was submitted to Government for sanction; the remodelling of the Darjeeling water-supply; the Mymensingh water-works extension scheme, and the Howrah drainage scheme. The Board dealt also with a number of miscellaneous references made to them by Government and by local authorities. The Sanitary Engineer paid visits to the municipalities of Dacca, Mymensingh, Howrah, Berhampore, Utterpara and Patna, either for the inspection of waterworks, sanitary works, or in connection with drainage schemes.

Assam.—Excluding four small towns which have no separate income, the total income of the municipalities, stations, unions, and towns in Assam was £14,530 as compared with £14,940 in 1901. The expenditure on sanitation amounted to £7,820 or 53·81 per cent. of the total income against 55·29 per cent. in the previous year.

Under conservancy £4,660 was spent against £4,860 in 1901; under water-supply £1,840 against £1,480; under drainage £640 against £730, while the balance was spent on minor sanitary works (£660), markets and slaughter-houses (£310), and vaccination (£78). The proportion of income spent by local bodies on sanitation ranged from 88·67 per cent. in the small town of Mangaldai to 22·58 per cent. in the town of Lakhimpur. Many minor sanitary improvements were effected by local boards in rural areas during the year, chiefly in connection with the extension and conservancy of the sources of water supply.

The Sanitary Board held two meetings during the year, and at other times business was conducted by the exchange of notes among the members.

United Provinces.—No details regarding municipal or district board income, or of the expenditure on sanitation, are furnished in the provincial report.

No new sanitary work of first-rate importance was undertaken during the year, but great advance was made towards efficiently draining sites and removing sullage water from the inhabited areas in the larger centres of population. At Allahabad, Cawnpore, Lucknow, Benares, Farrukhabad and Aligarh, large and important drainage works are under construction. At Benares the Dibdin system contact filters were in use throughout the year, except during the rains. They worked well, the effluent being of a high

standard and odourless. Other important projects in connection with drainage at Saharanpur, Kosi, Hathras, Haldwani, Deoband and Dehra Dun were either under consideration or actually sanctioned during the year under review, and at Mussoorie important sanitary improvements, towards the completion of which Government has granted half a lakh of rupees, were about to be commenced. In addition to this, the local Government has recognised the importance of an active sanitary policy as an integral part of the campaign against plague, and made a special allotment of £4,000 for experiments in improving the village water-supply, besides granting a subsidy of two lakhs of rupees to the more impoverished municipalities to assist them to carry out urgent sanitary measures which have been suspended for want of funds.

The amounts of filtered water supplied per head of population in the towns in which water-works are in operation were as follows. At Benares 15 gallons per head *per diem;* at Lucknow 5 gallons ; at Cawnpore over 13 gallons ; at Agra 9½ gallons ; at Allahabad 10 gallons ; at Meerut about 4 gallons ; at Dehra nearly 7 gallons ; at Mussoorie over 9 gallons ; and at Naini Tal 4 gallons.

Five meetings of the Sanitary Board were held during the year, when projects and estimates amounting to £72,930 for improving the sanitary condition of several municipalities were considered. A scheme for improving the drainage of Aligarh ; another for flushing the drains at Saharanpur ; and a third for constructing a *pucca* drain and culverts in Pilibhit were approved, and the Board also considered and recommended for sanction a project for branch sewers at Cawnpore, to cost £28,870. Various schemes for the extension and improvement of existing works for water-supply were also approved or considered, and plans for slaughter-houses and markets also received attention. The reports on the working of the Village Sanitation Act during 1901 were considered, and the Board passed a resolution that the improvement shown in the condition of sources of water-supply and in miscellaneous sanitary improvements of villages was satisfactory.

Punjab.—No details of municipal incomes or of the expenditure by municipalities on sanitary works are furnished by the Sanitary Commissioner of the Punjab in his report for the year under review.

The Sanitary Engineer gives a list of the projects prepared in his office or under his supervision during the year, as well as a list of sanitary works under construction. The sewerage system of Simla has been extended to serve all parts of the station, and there are now five distinct systems, which work independently, and lead to five different outfalls in the valleys below the station. A sufficient quantity of water is available in the streams at each of these outfalls in the driest time of the year to dilute the sewage to a strength of 10 gallons per head. At each outfall there will be disposal works where the sewage will be treated before it is discharged into the stream. The laying of all the mains (about 18 miles) was practically completed by the end of the year, but the disposal works were still in the experimental stage. At the main outfall an installation, consisting of a septic tank and a continuous filter, was under trial during the year under review. A larger installation to treat 40,000 gallons of sewage a day was under construction at the end of the year at the Kasumpti outfall. A project amounting to £6,150 for the drainage of the Simla bazaars was sanctioned and the work put in hand. An estimate for enlarging the existing distribution system of water-supply in Simla was also submitted for sanction. Work on the Amritsar water-works was commenced and was making good progress at the end of the year, but little or no progress was made with the drainage projects. In Umballa the extra-mural portion of the drainage scheme was commenced and was well advanced at the end of the year, and good progress was also made with the drainage works of Lyallpur ; at Lahore, sanction was obtained to the trial of a deep tube boring on Hughes and Lancaster's air lift system to raise water from a depth of 160 feet below ground surface.

The project sanctioned for increasing the water-supply of Kalka, at a cost of £2,860, was transferred to the Chief Engineer of the Kalka-Simla Railway for execution. The expenditure will be defrayed jointly by the Punjab Government, the East Indian Railway, and the Kalka-Simla Railway.

As regards rural areas, a considerable amount of activity was displayed by most district boards. The district board of Rawalpindi paid a reward of £10, which was distributed in three prizes, to village communities for improved sanitation, and similar rewards were offered by other boards. Sanitary note-books were in use in most districts, and are reported to supply valuable information to the inspecting officers regarding sanitary improvements.

The Sanitary Board of the Punjab met seven times during the year. The drainage schemes of the Simla bazaars, of Rawalpindi, Mooltan, Ferozepore, Gojra, Toba Tek Singh, and Sangla, as well as schemes in connection with the extension or improvement of the water-supplies of Simla, Amritsar, and Lahore, were considered and approved; the attention of the Board was also directed to the question of the selection of sites for new towns and other matters. To assist the execution of urgent sanitary works, shelved for want of funds, the local Government has decided to place an annual grant at the disposal of the Sanitary Board to enable it to contribute towards the cost of such works up to one-third the total cost. Further, an annual grant of £167 has been sanctioned to meet charges connected with experiments the Board may consider likely to assist in furthering the cause of sanitation and the execution of small works which would be delayed if formal sanction had to be obtained.

North-West Frontier Province.—The aggregate income in 1902 of the municipal towns in the North-West Frontier Province amounted to £34,480, the balance in hand at the beginning of the year being £10,800; and the amount expended on sanitary works was £8,940, or 25·9 per cent. of the income. This expenditure was incurred under the following main headings, the figures in brackets representing the expenditure under the same headings during 1901:—Conservancy establishment, £4,640 (£4,070); paving of streets, £622 (£680); roads and bridges, £1,020 (£836); drains and sewers, £1,010 (£1,060); water-supply, £1,480 (£1,930); construction of latrines, £76 (£68); widening streets, £60 (£190); repairs to latrines, £32 (£145).

The income derived from the sale of manure and street sweepings in all the municipal towns was £1,100, or £52 less than in the previous year.

No new work of capital importance was undertaken during the year, but in Peshawar city the water-supply was extended at a cost of £800, and a number of new surface drains constructed and old ones repaired at a cost of £700. In other parts of the province new wells were constructed, old ones cleaned, new pipes for drinking water were laid, and attention was given to various other minor sanitary matters.

No rewards appear to have been paid or *khilats* given to village communities during the year for special interest taken in sanitary improvements; and, so far, the village sanitary note-books do not appear to have been useful.

Central Provinces.—The total income of the district head-quarters municipalities of the Central Provinces during the year 1901–1902, excluding opening balances and receipts under the heads of "Grants and Contributions for general and special purposes" and "Extraordinary and Debt," amounted to £73,000 against £70,060 in the previous year. Of the total income, 31·78 per cent. was spent on sanitary works (original and recurring), 4·76 on medical relief, 0·07 on vaccination, and 1·37 on other sanitary requirements.

The chief sanitary works undertaken were in connection with the extension or completion of the water-supply projects of Nagpur, Bhandara, and Khandwa; £135 were also spent on the drainage survey of Nagpur. A number of minor works were carried out by municipalities, chiefly in connection with the construction and repair of drains and the improvement and extension of water-supplies.

As regards rural areas, expenditure was chiefly incurred in connection with general conservancy, including under this head the clearing of village sites.

During 1902 the Sanitary Board of the Central Provinces met in thirteen stations, the work done under their direction being chiefly in connection with the construction and repair of wells and the clearing of village sites.

Berar.—The estimated income of the municipalities in Berar during 1902 was £18,150, as compared with £17,580 in the previous year. The total expenditure, on sanitary measures under all heads, was £7,260, or 40 per cent. of income, as compared with 36 per cent. in the previous year. Outside the municipalities a total sum of £4,780 was expended by district boards, chiefly on drainage (£430), water-supply (£1,160), and "domestic cleansing" (£3,060). In 1900 the district boards spent £7,190, and in 1901 £5,140, so that the sum spent during the year under review shows a considerable fall.

The Sanitary Board met once at each head-quarter station during the year to consider what had been done by local bodies on the recommendations of the Sanitary Commissioner, as contained in his survey remarks in past years on towns and villages in the province.

Madras.—No details regarding income or expenditure are furnished in the provincial report. The Cocanada waterworks, begun in 1900, were well advanced at the end of the year under review, and Vizagapatam received its water-supply before the end of the year. Considerable grants were made to the towns of Madras and Ootacamund for the purpose of effecting sanitary improvements, and various schemes in connection with the water-supplies or drainage of Vellore, Saidapet, Masulipatam, Madura, Negapatam, Guntur, Kodaikanal, Dindigul, Adoni, Bezwada, Cuddapah, Ellore, Nellore, Trichinopoly, and Yercaud, were considered and dealt with.

Slow but steady improvement is being made in the conservancy of towns, which is largely attributed to the influence of certificated sanitary inspectors, of whom 110 are now employed by municipalities. Bacterial filters are gradually coming into use. Sewage farms or gardens continue to be worked with success where established. Cropping over nightsoil trenches, more especially as an object-lesson to ryots, is pursued at Erode, Cocanada, Rajahmundry, and Palni.

Steps have been taken to execute certain works in the vicinity of Guindy, to carry out experiments to ascertain what particular method of filtration of sewage would be most effective, and whether it would pay the ryot to erect rough filters for filtering town sewage to secure the effluent as manure.

The Sanitary Commissioner observes that a condition of stagnation has overtaken municipal efforts in regard to sanitary improvement since free grants to aid large works have been discontinued. Although conditions prevent help being given as easily as before, some progress was made during the year. The Presidential Government is, however, of opinion that in rural sanitation too little attention is devoted to the execution of works of permanent improvement, such as the efficient protection of wells, the construction of drains, and the provision of simple and serviceable latrines, while too large a proportion of the available funds is spent on establishment.

During the year the Board scrutinised the plans and estimates of 123 sanitary works, of which 52 were for municipalities, 66 for Local Fund Boards, 4 for the Collector of Salem, and 1 for the Collector of Madura, the aggregate estimated cost of the projects being £110,800.

The following were among the more important schemes and estimates considered:—

(1) The water supplies of Guntur (£34,230) and Tiruvannamalai (£11,800).
(2) A scheme to connect the Cuddapah waterworks with the Peddagadi natural reservoir (£10,000).
(3) Hospitals at Madura (£6,900), Bezwada, and Nandyal.

Coorg.—Particulars regarding the income and expenditure on sanitation of the municipal towns or of the district boards are not given in the provincial report; but beyond the construction of surface drains in the Mercara municipality no expenditure on sanitation calling for special remark was incurred.

No regular meetings of the Sanitary Board were held during the year, and the only question of importance to which attention was directed was the expedience of controlling wet cultivation within municipal limits as a preventive measure against the spread of malaria, and the extension of such cultivation was prohibited by a resolution of the Municipal Committee.

Bombay.—Excluding the Presidency town, there were 165 municipalities in Bombay during the year 1901–1902, and their aggregate income amounted to £414,910. Out of this sum £94,760 were expended on improving water-supply, on drainage, and on conservancy within municipal limits.

The income of the local boards during the year 1901–1902 amounted to £295,920, of which £10,740 were spent on water supply and drainage.

The Bombay Village Sanitation Act of 1889 has been introduced into 294 villages, but it is explained that owing to famine and plague, which claimed the attention of district officers, no progress was made.

The drainage works of Ahmedabad city, estimated to cost about 11 lakhs, were commenced.

The number of meetings of the Sanitary Board is not reported, but their attention during the year was occupied with projects and proposals in connection with the water-supplies of Poona city, Ahmedabad, Hyderabad (Sind), and Sukkur, as well as in connection with the drainage of Poona, Ahmedabad, and Nadiad.

The experiments on the Manjri experimental sewage farm were commenced in February, 1902. The septic tank and bacteria beds worked satisfactorily, and the crops irrigated by the effluent from the tank and by the filtrate from the bacteria beds were equally good.*

Burma.—The aggregate income of the 42 municipalities in Burma during 1902, including opening balances, amounted to £596,400, against £440,240 in the previous year. Out of this sum £293,770, or 49 per cent., were spent on sanitary works, as compared with 35 per cent. spent in 1901.

On rural sanitation £11,560 were spent during 1902, as compared with £9,960 during 1901.

At Rangoon a substantial addition was made to the water-supply by means of tube wells sunk in the Ahlone quarter. These wells yielded from 400,000 to 500,000 gallons of pure and potable water per day.

More than half the work on the Hlawga water-supply scheme was completed, and it was anticipated that the whole work would be finished in 1903.

A water-supply scheme for Akyab, at a cost of nearly 4 lakhs, has been submitted to the Sanitary Board for approval, and a scheme to improve the water-supply of Prome, at an estimated cost of over a lakh and a quarter, has been undertaken. Steady progress is being made in the surface drainage of Prome, which affords an example of carrying out the work piecemeal year by year till completed, instead of waiting indefinitely until funds can be found to carry out the complete work.

At Mandalay £1,320 were spent on surface drainage. In connection with water supply and conservancy, however, but little progress has been made. At Moulmein the water-supply scheme, to which reference has been made in previous reports, is under construction, and the work is said to be well advanced. The sinking of a tube well for the Shwebo Cantonment, at a cost of over £270, was sanctioned.

Three meetings of the Sanitary Board were held during the year—one at Akyab and two at Rangoon. At these meetings projects and estimates for sanitary work were considered, chiefly in connection with the water-supply and drainage of Akyab, the water-supply of the town of Myingyan, and the formation of railway towns at Khamonseik and Tharrowan. It is represented that local authorities do not at present regularly consult the Board.

General Remarks.

Red Sea Pilgrim traffic.—On account of the continued prevalence of plague at the end of 1901 the Government of India again found it necessary to impose restrictions with regard to pilgrimage to the Hejaz, and in view of the stringent quarantine rules of the Turkish Government and the inconvenience likely to be experienced by Indian pilgrims in Arabia, all who intended making the journey were again advised to defer their visit to another season. Karachi had been declared a plague-infected port, so it was closed for the embarkation of pilgrims, but arrangements were made at Porbandar in the Bombay Presidency, and at Chittagong, for the embarkation of pilgrims from areas unaffected by plague. At these two places alone could tickets for the voyage be purchased, and persons permanently or temporarily resident in any infected places were not permitted to embark. At Porbandar and at Chittagong observation camps were established, where the pilgrims, after disinfection of their clothing and other effects, were detained for the usual period of observation before embarkation. Pilgrims from uninfected parts of the Madras Presidency were kept under observation for 10 days, and their clothing and effects disinfected in camps established in the Presidency, and then despatched by sea from ports other than Madras to Porbandar.

Seven steamers carrying in all 3,609 pilgrims left Chittagong, and three steamers carrying 1,057 pilgrims left Porbandar. Two cases of small-pox occurred on one of the steamers from Porbandar, but the disease did not spread among the pilgrims, and no case occurred during the period of their detention at Camaran.

* A full account of these experiments will be found in the Agricultural Ledger, 1903, No. 2. "The Agricultural Value of City Sewage in India," by J. W. Leather, Ph. D., F.I.C., Agricultural Chemist to the Government of India, and J. Mollison, M.R.A.C., Inspector-General of Agriculture in India.

The total number of deaths among the Indian pilgrims at sea *en route* to Camaran was 23, the principal causes of death being senile debility, chronic heart and lung affections, and malaria.

The health of the pilgrims during their detention at Camaran was particularly good, and no plague, cholera, or other infectious disease made its appearance on the island. Among British Indians 13 deaths are reported to have occurred while at this place. It is said that the hospitals in the camps are very badly ventilated, that they have no water-supply laid on, and that they are without any lavatory, kitchen, or latrine, set apart for the sick.

A serious outbreak of cholera occurred in the Hejaz, but British subjects suffered only slightly.

One vessel only, the s.s. *Amahdi*, brought returning pilgrims to Bengal during 1902. She left Jeddah with 458 pilgrims, of whom 441 were landed at Diamond Harbour, and, after disinfection of their clothing and effects, were sent to their homes by rail. Seventeen deaths in all occurred on the ship during the voyage, but no one of them was due to infectious disease.

The pilgrims returning to Bombay numbered 3,570 and were conveyed by 13 vessels, some of which made more than one journey. During the voyage of the s.s. *Vadala* one case of small-pox occurred, the patient being removed to hospital on shore at Bombay. The remaining pilgrims were vaccinated and their clothing and bedding thoroughly disinfected. On the other pilgrim vessels there was no sickness of an infectious nature among the crew or passengers. Pilgrims whose homes were up-country or beyond the frontier were not allowed to enter the town, but were handed over to the Protector of Pilgrims to be sent direct from the disinfection sheds to their homes by rail.

The dues levied at Camaran on Indian pilgrims amounted to $68\frac{3}{4}$ piastres, equivalent to Rs. $12\frac{1}{2}$ at the rate of exchange current there; and the British Vice-Consul complains of the exceedingly unfair rate at which the amount due is converted into Indian currency; for while it appears that £1 sterling realises 109 piastres, its equivalent, when proffered in rupees, realises only $82\frac{1}{2}$ piastres. He recommends that, as the sanitary administration would not suffer by a fairer rate of exchange—the staff alone effecting a profit at the expense of the Indian pilgrims—the Sanitary Board at Constantinople should accept Indian coinage at the rate of 7 piastres to the rupee, as was formerly the case, instead of at the rate of only $5\frac{1}{2}$ piastres as at present.

The Delhi Durbar.—It is satisfactory that from the point of view of health, as well as in other respects, the Coronation Durbar at Delhi was a remarkable success. The collection on one spot of such a large number of natives from all parts of India rendered the importation of many cases of disease not only possible but probable, but it was effected with the occurrence of only a very few isolated cases of plague, which did not act as foci for the spread of the disease. The difficulties to be contended with in the creation on the bare plain of a large town of about 100,000 inhabitants, with four suburbs each containing from five to ten thousand people, for all of whom adequate arrangements for the supply of food, water, hospital accommodation, conservancy, &c., had to be made, were necessarily great, and it speaks well for the forethought and organising powers of the officials entrusted with the formation of the camps that all the arrangements worked so perfectly and that no hitch occurred. There was abundance of food, and the establishment of a public market by the Supply and Transport Department prevented prices in Delhi from rising much, if at all, above the normal. The supply of water in the central camps was unlimited; drawn from the Jumna above Delhi it was passed through the filter beds of the Delhi waterworks, and distributed through all the camps in pipes, so that contamination was impossible.

The conservancy arrangements, devised and carried out by Lieutenant-Colonel Thornhill Executive Sanitary Officer and Special Magistrate for the Durbar, were a perfect success. A liberal supply of latrines and of removal staff and plant, ensured the rapid disposal of the night-soil, and no accumulation ever occurred. Special roads, metalled and lighted, were made to the trenches, and as the carts worked at night, they were never in evidence.

The medical and sanitary arrangements were under the control of the Durbar Medical Staff, composed of Lieutenant-Colonel C. J. Bamber, I.M.S., as Administrative Medical Officer, Major F. Wyville-Thomson, I.M.S., as Special Health Officer, and Captain C. H. James, I.M.S., as Special Plague Officer, with a staff of two Assistant Surgeons and eight Hospital Assistants. In addition, each Provincial Government and

Native State brought its own medical officer and subordinates, with tents and equipment for a small hospital. An outdoor dispensary in charge of a Hospital Assistant had been established in the central camp in June for the treatment of natives employed on the Durbar works. This proved very useful, 5,000 cases being treated between the end of June and the end of January. A civil followers' hospital of 32 beds had also been established for all natives not otherwise arranged for, and for any overflow cases from the central camps. Separate arrangements were made by the Durbar Medical Staff for the segregation and treatment of cases of infectious disease; and to enable any outbreak of plague to be effectually dealt with, special regulations for the Durbar area were issued by the Punjab Government, giving the Central Committee general control over plague operations, and detailing the steps to be taken and the rules to be observed on the appearance of plague. Four segregation hospitals, fully equipped in every respect, were erected at different points. Fortunately these arrangements were never severely taxed, for only ten cases of plague occurred altogether. Although these cases occurred in eight different camps, in no instance did a second case follow the original one—a result which was doubtless due to the open-air life in tents, to the prompt recognition of the disease, and to the rapidity with which preventive measures were taken. The Durbar was practically free from other infectious diseases. No cholera appeared, and there were only five cases of small-pox, all in the military camps. As regards general diseases the camps were very healthy, and owing to the warm weather and freedom from rain and cold winds, chest diseases and pneumonia were not frequent or severe. The total number of cases treated in the civil followers' hospital and reported by the medical officers of the different camps (excluding all the troops) for the period from the 20th of December to the 10th of January, is shown in the accompanying table, but as the medical officers in many cases included their out-patients in the returns, the figures show a large excess over the actual number of serious cases in hospital.

—	Cases.	Deaths.
Malarial fever	1,564	4
Pneumonia	365	22
Other chest diseases	1,570	11
Dysentery and diarrhœa...	548	3
All other causes	2,828	29
Total	6,875	69

Malaria.—The important test experiments on measures for the prevention of malaria, which were commenced in Mian Mir in April, 1902, have been carried on up to the present time. A summary of the results obtained at the end of the fever season of 1902 was given in last report, and the narrative may be continued here. It will be remembered that, although the operations during the summer had brought about a reduction in the numbers of adult *anopheles* mosquitoes, yet, in spite of the checks upon their breeding, adult *A. culicifacies* and *A. Rossii* could be readily found in houses in the area of operations from July to November. During the latter month and the next the numbers of adult *anopheles* present in the houses and the numbers of larvæ in the breeding places decreased very rapidly, until at the end of December not a single adult *anopheles* could be found. A similar disappearance of adults was, however, observed in parts of the cantonment where no operations had been carried on, and in villages far removed from Mian Mir, so that their absence from houses in the area could not be ascribed to the effect of the operations. It was found, however, that although all adult *anopheles* had disappeared, a number of larvæ of *A. culicifacies* still remained alive, in a more or less "hybernating" condition, in permanent pools and other collections of water. The operations during the winter were therefore directed chiefly towards the destruction of all these "hybernating" larvæ within a wide radius of the area of operations. As no new batches of eggs or larvæ appeared in pools which had once been freed of them, this was a comparatively easy task,

and before the end of the winter all larvæ were destroyed within a radius of nearly two miles in every direction from the outer limits of the area. The limit of flight of *anopheles* mosquitoes is usually considered to be about half a mile, and as at the end of the winter no adults or larvæ were present within two miles of the area, it was a matter of considerable interest to see whether they would reappear in the area in the spring. This matter was not long in doubt, for at the end of April it was noticed that larvæ of *A. culicifacies* were being washed down into the area along the irrigation canals from places outside, and soon afterwards a few adults of this species were found in the houses of the area. Other methods by which adult *anopheles* mosquitoes reached the area were found to be (1) by flight over a comparatively long distance; (2) by the gradual spreading of adult mosquitoes in all directions from areas in which they were abundant; (3) by the introduction of adult *anopheles* into the area in carriages, carts, and other vehicles. When all these methods are taken into consideration it is not surprising that, in spite of the vigorous operations during the winter, *anopheles* mosquitoes were again almost as prevalent in the area at the end of May as they had been soon after the beginning of the previous year's work. The results of one year's work could not, however, be regarded as conclusive, and the task of controlling the breeding of *anopheles* mosquitoes was again taken up under more favourable conditions than in the previous year; for the staff of labourers knew their work, a large number of permanent breeding places had been done away with, and the canals had been thoroughly cleaned and repaired. At the commencement of July, Captain James handed over the control of the operations to Lieutenant S. R. Christophers, under whose direction they were carried on throughout the summer and autumn.

In the main the operations were similar to those of the previous year. The extent of area treated was, however, enlarged, and the destruction of breeding places carried out up to three-quarters of a mile from the Royal Artillery barracks and bazaar.

The operations against *anopheles* were mainly directed against larvæ, and the permanent removal of all breeding places within the area was, as far as possible, attempted. The nature of some of the breeding places (*i.e.*, more especially the irrigation channels) did not allow of this, and the larvæ were destroyed by kerosene oil at short regular intervals.

A most important part of the operations consisted, as in the previous year, of measures directed against the breeding in the irrigation channels of *A. culicifacies*, this species being apparently chiefly concerned in the spread of malaria in Mian Mir. The "cleaning" of the canals, which had been continuously kept up, had appeared to lessen the numbers of larvæ present, but, as the season advanced, larvæ of *A. culicifacies* became more and more abundant, and it was found necessary, in addition to "cleaning," to oil at intervals of 10 days the whole of the canals in the area. The effect of the measures was to almost completely prevent the presence of nymphæ in the canals treated. Young larvæ, however, appeared within a few days of each oiling and in *rapidly increasing numbers*. Indeed, it appeared evident that adults of *A. culicifacies* were increasing in number in spite of the operations.

The rain-formed pools which appeared with the first fall of rain on July 15th necessitated operations of a different kind. In these waters *A. Rossii* was alone abundant, while *A. culicifacies* remained confined to the canals and their overflows. As a result of the formation of numerous pools by the rains a remarkable increase in the numbers of *A. Rossii* took place, the increase being so rapid and striking as to merit the term "swarming"—a phenomenon well known in the case of some insects.

In dealing with rain-formed waters, drainage by means of earth-cut drains was found the most satisfactory of all the operations. By this means the area immediately around the barracks and bazaar became automatically free from standing water within 24 hours of the cessation of rain. In the outlying area one or other of the following operations was adopted, as seemed suitable:—Drainage, filling with earth, drying by baling out the water, and oiling with kerosene oil. From the great care taken to search out all breeding places it is extremely unlikely that any considerable source of *A. Rossii* was left within the area of operations.

Adult *anopheles*, however, both *A. culicifacies* and *A. Rossii*, appeared in increasing numbers in the bazaars and stables adjoining the barracks. The operations, therefore, though apparently very satisfactory as regards the destruction of larvæ, failed to show any demonstrable reduction of adults. This failure to affect the numbers of adults appeared to be mainly due to the passage of these from beyond the area of operations; and in two instances the undoubted flight of *A. Rossii* from 900 yards and three-quarters of a mile, respectively, was established.

The effect of the operations upon malaria was at first distinctly noticeable. As the fever season advanced, however, the operations appeared quite futile, and both among the troops and in the bazaar malaria became rife. During August and September (1903) the admissions for malaria among the Royal Artillery (troops within the area) were 24, or a ratio of 48 per 1,000 per month. During the same months the admissions among the British Infantry (troops outside the area) were 121, or 128 per 1,000 per month. There certainly appeared in these two months to be a reduction in the amount of malaria among troops living in the area of operations. In October, however, the Royal Artillery showed 318 admissions per 1,000 per month, as against 187 per 1,000 per month among the British Infantry, and for November 428 as against 278 per 1,000. The low figures of the British Infantry were probably due to the very strict quinine administration, but the number of admissions among the Royal Artillery were not diminished as compared with past years. The admissions for the whole season, from July 1st to November 30th, indeed, were considerably in favour of troops living outside the area as compared with those living within it, namely, 158 per 1,000 per month, as against 216 per 1,000 per month, respectively.

The effect of the operations upon malaria among natives was also very distinct in the early part of the season. As in the case of the troops, however, any appreciable diminution of the endemic index in October and November was not apparent. The incidence of malaria among the inhabitants of the bazaars corresponded with that among the troops. Thus, at the time (August and September) when the admission rate among the Royal Artillery was very low in comparison with that of the British Infantry, the endemic indices of two bazaars in the area were remarkably small as compared with the endemic index of untreated native communities. In October and November malaria among bazaar children in the area was as severe as in former years, and as in the British Infantry bazaar in the present year.

In addition to anti-mosquito measures, experiments were carried out as to the value of quinine administration to troops and native children. The experiments fall naturally under three heads :—

(1) Those conducted with strict scientific accuracy.
(2) Those under personal supervision, and as strictly carried out as is possible when dealing with large bodies of men.
(3) Those conducted either under supervision as ordinarily practised, or under no supervision at all.

A limited number (100) of the British Infantry soldiers, who had volunteered to take quinine regularly under supervision, were given 15 grains of quinine on two consecutive days each week. The number of admissions for malaria among these men was in striking contrast to the number among the remainder of the men who did not take quinine. During the time of the experiment (four weeks) two cases only were admitted out of the 82 men who had really taken quinine regularly. In neither of these cases were parasites found. Among the remaining 360 men, 67 cases of malaria were admitted into hospital.

After the conclusion of the above experiment the whole of the British Infantry were placed under compulsory quinine treatment, and the taking of quinine supervised with the greatest possible strictness. A distinct reduction in the admission rate resulted, but not so markedly as in the case of the smaller experiment.

Other troops in Mian Mir were placed upon quinine under the conditions noted under Class 3. No effect whatever was apparent.

Quinine was administered to the children of a native community (syce lines). It was found that in a small community of natives quinine administration to the children was by no means so difficult as might have been anticipated. A list of all the children living in the lines was readily obtained from the cantonment authorities, and it was found that the children took considerable doses of quinine for a reward of native sweets. The administration of quinine was rapidly effective in reducing the spleen rate among the children. During the administration of quinine the spleen rates of the children in these lines showed a reduction from 67·8 per cent. to 54 per cent. At the same time the spleen rate in two other native communities had risen from 36 per cent. to 64 per cent., and from 41 per cent. to 60 per cent., respectively.

It is customary in describing operations against mosquitoes to discuss the results in the most optimistic way. It is noticeable, however, that very rarely is any attempt made to measure the effect of the operations by accurate observations regarding a reduction in adult mosquitoes, nor, it is thought, has any such definite proof as a diminution in endemic index been attempted except in the operations summarised above. Such

statements as "malaria has lost its terrors for us," or, "all the natives remark that they are not nearly so much troubled by mosquitoes as they were," are, of course, incapable of being refuted, but, on the other hand, they afford no evidence of a reduction of either malaria or mosquitoes. Even apart from these considerations it is difficult to understand, in the face of the results obtained at Mian Mir, the easy success of some reported anti-mosquito operations. The present operations, so far as destruction of larvæ was concerned, were eminently successful. Moreover, a reduction for a time of the endemic index of a bazaar and of the admission rate of the troops was apparently achieved. Nevertheless, taking into consideration the length of time during which the operations have been carried on, the fact that they were conducted under favourable conditions, and that they were controlled during both the years of observation by medical officers possessing expert knowledge of the subject, the success attained scarcely warrants the conclusion that anti-mosquito operations would be an efficient practicable measure in every cantonment. Moreover, it must be remembered that, even had the operations been more successful, about one-quarter only of the whole cantonment of Mian Mir was taken in hand, and that to deal with this portion alone required all the energies of a medical officer wholly devoted to the task. On the whole, therefore, it would appear that the results of the present experiment were distinctly against the employment of anti-mosquito measures as a practical means of combating malaria in such a cantonment as Mian Mir.

As regards the administration of quinine to troops, the experiments clearly showed that the administration of 15 grains of quinine on two successive days weekly was a most powerful means of combating malaria. At the same time, however, they demonstated the great difficulty of applying this means of prophylaxis to large bodies of men, and the necessity, which has been so often emphasised in these pages, of ensuring that the quinine is given under the immediate supervision of a medical officer. It may even be said that the difference in the results of accurate experiment and of administration as ordinarily practised was so marked, that it appears doubtful whether, with the means of supervision at present available, this measure could be applied with much benefit as a routine one to troops.*

The first edition of 5,000 copies of the pamphlet on the causation and prevention of malarial fevers, which was drawn up by Captain James for the use of Assistant Surgeons and others, was soon exhausted. In the preparation of a second edition, the text has been revised, illustrations have been added, and the scope of the work has been enlarged so as to make it an easy introduction to the study of malaria. The new edition was issued in November, 1903, and has already been widely circulated. In connection with this subject attention may also be drawn to the books entitled "The Practical Study of Malaria," by Dr. J. W. W. Stephens and Lieutenant S. R. Christophers, I.M.S., and "Laboratory Studies in Tropical Medicine," by Dr. Daniels of the Colonial Medical Service.

Malta fever.—In 1897 Professor Wright directed attention to the possibility that Mediterranean or undulant fever might be prevalent in India as well as in the Mediterranean basin. His surmise was based upon the fact that in the cases of ten soldiers who had been invalided from India he had obtained serum reactions with the *Micrococcus melitensis*. Six of the men, however, had previously served in Mediterranean stations, and except in one of the remaining four cases the highest dilution in which the sero-sedimentation effect was obtained upon the micrococcus was 1 : 200. Captain Lamb, I.M.S., afterwards published an account of several cases of anomalous fever occurring among Europeans in Bombay, in which serum reactions were obtained with the micrococcus, and Lieutenant Greig, I.M.S., published an account of three cases of fever occurring among natives in the Swat valley, in the first of which a sero-sedimentation reaction was obtained in a dilution of 1 : 120, in the second in a dilution of 1 : 90, and in third in a dilution of 1 : 40.

That Malta fever should occur among European soldiers recently arrived from regions where the disease is endemic is perhaps to be expected, but whether this fever is indigenous in India and of common occurrence among natives cannot be said to be definitely known. If reported cases of the disease are to be accepted, it certainly would appear that Malta fever arising from local conditions is of frequent occurrence in India. A study of the histories of cases returned under this heading by medical officers

* Full particulars of the operations will be found in No. 6 of the "Scientific Memoirs" (New Series); first report of the anti-malarial operations at Mian Mir (1901–1903), by Captain S. P. James. I.M.S., and in the forthcoming second report by Lieutenant S. R. Christophers, I.M.S.

in charge of British and native troops and jails, however, throws some doubt on the accuracy of the diagnosis of Malta fever. Many of the cases have exhibited very few, if any, clinical symptoms of the disease and appear to have been returned as Malta fever on the strength of a positive serum reaction alone. It is not impossible that some of these diagnoses were based upon a mistaken valuation of the results of a serum test. It is, perhaps, unnecessary to point out that normal serum has the power of agglutinating most organisms to a certain extent, and that a positive result with a serum and an organism cannot be called specific unless the reaction occurs in sufficiently great dilution ; the so-called specific reaction is indeed merely a reaction at such dilutions as are impossible in the case of normal serum. It is sometimes forgotten, however, that not only is the agglutinating power of individual normal sera very variable, but that an organism by becoming attenuated in virulence, is rendered indefinitely susceptible to agglutination by normal serum. A sufficiently attenuated typhoid organism may from this cause give reactions readily with normal sera in dilutions of 1 : 100. In order to avoid all chance of this action of normal serum upon organisms possibly very susceptible, most observers have found it necessary in carrying out the test to adopt (1) a short time limit, (2) complete reaction, and (3) reaction at high dilutions, as the three essential requirements for accurate diagnosis. A reaction in dilution 1 : 80, for example, in the case of an organism so susceptible and liable to changes as the *Micrococcus melitensis* does not appear to be sufficiently high to be of undoubted specific nature, and until experiments have been made as to the susceptibility of such cultures of the micrococcus as are available in India to the sera of apparently healthy Europeans and natives, and to the sera of persons suffering from other diseases, it is impossible not to be sceptical regarding the correctness of some of the diagnoses of Malta fever based upon serum tests alone. At any rate it is extremely desirable that a more critical attitude should be taken up in the employment of serum diagnosis, for it is a significant fact that, although for more than five years Malta fever has been regarded as a fairly common disease of India, the micrococcus itself has not yet been isolated from any case.

Trypanosomiasis.—The recent discovery of parasites of the genus *Trypanosoma* in the blood of Europeans and natives in Africa has aroused considerable interest, and the Government of India, recognising the possibility that in this discovery might lie the clue to the causation of certain obscure diseases of India, deputed an officer of the Indian Medical Service to join the members of the Royal Society's Commission, who had proceeded to Uganda in February, 1903, to investigate the disease known as " sleeping sickness." Captain E. D. W. Greig, I.M.S., was selected for the duty, and joined Lieutenant-Colonel D. Bruce, F.R.S., R.A.M.C., and Dr. Nabarro, the Commissioners of the Society, at Entebbe in Uganda on the 25th of May.

There is evidence that observers in this country have not been slow to follow the lead of their *confrères* in Africa in recognising the importance of the new discovery. In several parts of India search has already been made for trypanosomes in the blood of man, but so far without success. As a result of the recent researches, however, further investigation of these parasites, both in men and animals in India, is likely to become more general, and in view of the fact that the literature bearing upon this subject is not everywhere available, a brief summary of the landmarks of our knowledge regarding trypanosomiasis may not be out of place here.

In November, 1843, Gruby described a protozoal parasite of the blood of the frog to which on account of its peculiar boring movements he gave the name *Trypanosoma sanguinis* (Gr. *trupanon*, an auger). Gluge had possibly observed the same parasite in 1842, and it was probably also identical with the *Amoeba rotatoria* observed by Mayer in July, 1843, and perhaps, with the *Undulina ranarum* described by Ray Lankester in 1871. The " vermicules " which were observed by Gros in 1845 in the blood of a field-mouse and by Chaussat in 1850 in the blood of rats (*Mus rattus*) were also probably of the nature of trypanosomes ; but it was not until the researches of Lewis in 1877 that the first accurate description of these parasites in the blood of warm-blooded animals was given. Lewis made his discovery of flagellated organisms in the blood of rats in July, 1877 during an examination of these animals in connection with an investition into spirillum fever at Bombay, and he afterwards found that 29 per cent. of the apparently healthy rats (*Mus decumanus* and *Mus rufescens*) examined by him at Calcutta, harboured the parasites. He found them also in the rats at Simla and other places in India, and Vandyke Carter found them in 12 per cent. of the rats examined at Bombay. The next discovery—truly, as Vandyke Carter said, an epoch-making one—was made by Veterinary Surgeon Griffith Evans, who in 1880 submitted a report on

"surra," as a newly-diagnosed disease very prevalent among horses in the stations of the North-West Frontier, and constantly associated with the presence of numerous organisms in the blood. Lewis regarded these organisms as very similar, if not identical, with the flagellated organisms discovered by him in the blood of rats. Evans showed by experiment that the surra parasites and disease were both communicable by inoculation to healthy horses and to dogs. In January 1885 Veterinary-Surgeon J. H. Steel, when investigating a hitherto unrecognised disease among the transport mules in British Burma, found it to be the same as the "surra" of the North-West Provinces, and showed further that the monkey was susceptible to this infection. Steel sent specimens of contaminated blood from mules, dogs, and monkeys to Vandyke Carter at Bombay, who came to the conclusion that morphologically the hæmatozoon of surra was identical with that of apparently healthy rats. In 1886 Cunningham also found parasites which he regarded as identical with those of Lewis, Steel, and Evans, in slides of blood from horses, mules, and ponies, suffering at Meerut from an epidemic disease which had come under the observation of Veterinary-Surgeon W. D. Gunn. Steel and Evans had conclusively shown that both the disease and the parasites of surra were readily communicable by inoculation to other animals, and Vandyke Carter had shown that it was very difficult, if not impossible, to communicate the rat parasites by inoculation to the dog, cat, horse or monkey. Out of 15 inoculation experiments carried out with contaminated rats' blood by him on these animals and on one other rat, in only one case (that of a monkey) was a positive result obtained, and in that case the parasites were present in the inoculated animal only on the 2nd and 3rd days after the experiment : they then disappeared and the animal remained perfectly well. In spite of these facts and in spite of the fact that the rats harbouring the parasites did not apparently suffer from any disease, Vandyke Carter as well as Lewis, Steel, and others, regarded the rat parasites as probably identical with those of "surra"—Vandyke Carter making the remark that India was the seat of a widespread and very serious equine disease, having for one of its characteristics a blood contamination seemingly identical with one largely prevalent among common rodents of the country.

In the meantime the attention of observers in Europe had been directed to the subject, and in 1881 Koch and v. Wittich discovered a parasite in the hamster which appeared at the time to be identical with the parasite of rats, but which Laveran and Mesnil now consider to be a distinct species. Kent in 1882 described the parasite of the rat under the name *Herpetomonas lewisi* and in 1886 Crookshank, who had found the parasites in 25 per cent. of the rats examined by him in London, regarded them as belonging to the genus *Trichomonas*. The parasites of rats were also studied by Danilewsky, Chalachnikow, and others. In 1894 Bruce discovered that the disease of horses and other animals in Africa called "nagana" is caused by a trypanosome very similar, if not identical, with that which causes "surra" in India, and that the disease is communicated from animal to animal by means of the tsetse-fly ; and in 1896 Rouget's discovery of an apparently new species of the genus *Trypanosoma* as the causative agent of the disease of horses called "dourine" or *mal du coît* added further interest to the subject In November 1896 Bruce sent a dog infected with "nagana" to England, which formed the starting point of the researches of Kanthack, Durham, and Blandford in London and Cambridge. Plimmer and Blandford afterwards continued the researches in London and published their results in 1899. In the same and the next year Rabinowitsch and Kempner and Wasilewski and Senn published accounts of their researches on rat trypanosomes, which were followed in 1901 and later years by a very important series of observations on parasites of this genus by Laveran and Mesnil. For some time it was thought that the *T. lewisi* of rats and the *T. evansi* of "surra" were identical, but Koch, Rabinowitsch and Kempner, and Laveran and Mesnil have shown that the *T. lewisi* is peculiar to rats. Even the hamster which, as mentioned above, is frequently infected with a trypanosome very closely allied to *T. lewisi*, is refractory to this parasite. Morphologically also the two parasites present differences by which, according to Laveran and Mesnil, they can be distinguished. Koch, Nocard, and others have expressed the opinion that the parasite of surra (*T. evansi*) and that of nagana (*T. brucei*) are identical. In spite of the voluminous memoirs of Lingard on surra, the structure of this parasite is still very incompletely known, so that a complete morphological comparison of the parasites is not possible. The same animals are susceptible to the two diseases and in the horse the course of the two diseases is similar. In the case of experimental inoculation also the incubation period of the two diseases is the same. On the other hand, whilst cattle, according to Bruce, nearly always die of nagana, they usually recover from surra. In Zululand Bruce also came to the conclusion that the tsetse-fly was the only one capable of carrying nagana. This would point to the fact that nagana is distinct from surra, for, according to Austen, the tsetse-fly occurs only in Africa ;

and the observation of Captain Rogers, I.M.S., that surra is carried from animal to animal by means of horse-flies, probably adds further evidence of the distinctness of the two diseases, instead of, as he suggests, pointing to their being identical. The question cannot, however, be decided definitely until the experiment of immunizing animals against the parasites of surra and then ascertaining if they are susceptible to an infection with the parasites of nagana has been made. A third important disease of animals associated with the presence of trypanosomes in the blood affects horses in South America and is known as *mal de caderas*. The discovery of the parasite of this disease was made by Elmassian in 1901, and confirmed by Voges in the same year. Morphologically the parasite resembles very closely those of surra and nagana, and though Lignières and Elmassian and Migone were unable to detect the presence of a "centrosome" at the point of insertion of the flagellum, Laveran and Mesnil succeeded in doing so. As in nagana and surra all animals experimented with up to the present have been found to be susceptible to the disease, but Laveran and Mesnil have shown that a goat and sheep, which had recovered from nagana, and which, therefore, possessed an immunity against this affection, readily contracted an infection with the parasite of *mal de caderas*. The converse experiment of infecting an animal which had recovered from *mal de caderas* with the trypanosome of nagana was successfully made by Lignières, so that the trypanosome of this disease would appear to be quite distinct from that of nagana. The last disease of animals caused by trypanosomes, to which it is needful to refer here, is that known as "dourine" or *mal du coît*, a disease of horses which has been carefully studied in India by Veterinary-Major Pease. It is probable that the parasite of this disease was first seen by Chauvrat in 1892, but he regarded the case as one of surra, and the merit of having first discovered the parasite is usually ascribed to Rouget, who in 1896 observed it in the case of a horse suffering from the disease. Although morphologically resembling the parasties of surra and nagana, the parasite of dourine [*T. equiperdum* (Doflein) or *T. rougeti* (Laveran and Mesnil)] is now regarded as quite distinct from these as well as from the parasite of *mal de caderas*. The only known way by which dourine is naturally communicated is by coitus* ; the course of the disease in animals is different from that of nagana or surra ; its duration is generally some months ; the parasite is very rare in the blood ; and above all, many animals such as monkeys, guinea-pigs, goats, sheep and cattle, which are susceptible to nagana are quite insusceptible to dourine. Nocard also has shown that dogs immunized against dourine succumbed to nagana in 11–14 days, and Lignières has shown that dogs immunized against dourine succumbed to an infection with *mal de caderas*, so that the parasite would appear to be certainly distinct.

It will suffice to conclude this *résumé* with a brief account of the recent discoveries relating to trypanosoma disease in man. Nepveu (in 1891) appears to have been the first to recognise trypanosomes in the blood of man, but although he maintained that these parasites must be reckoned with as a factor in tropical pathology, little attention was directed to his discovery, and it remained for Dutton to bring the subject into prominence by his recognition and description of a parasite found by Forde in 1902 in the blood of a European in Gambia. Dutton also found the parasites in the blood of an apparently healthy native child in the same district, and later he and Todd found six more cases of trypanosomiasis among 1,000 individuals whose blood they examined. Manson and Daniels added another case in the person of a European from the Congo, and the occurrence of cases in other parts of Africa was reported by Le Moal, Brumpt and Broeden. In November 1902 Castellani discovered that the infection occurred among the natives of Uganda, and made the important observation that in some cases of sleeping sickness trypanosomes were to be found in the cerebro-spinal fluid. Out of 34 cases of sleeping sickness he found trypanosomes in the cerebro-spinal fluid in 20. His discovery was confirmed by Bruce, who, with Nabarro, had been sent out as a Commission by the Royal Society to make further investigations into this disease. Up to the end of May 1903 Bruce and Nabarro had studied 40 cases of sleeping sickness and had found trypanosomes in the cerebro-spinal fluid in all, and in the blood in 15 out of 16. Later the blood of a number of inhabitants of sleeping sickness and non-sleeping sickness areas was examined by the Commission. Out of 80 natives from a sleeping-sickness area, 23 or 28·7 per cent. were found to have trypanosomes in their blood, while in the examinations of 117 natives from areas where sleeping sickness was unknown not a single trypanosome was found. The Commissioners report that the parasites were never found in the cerebro-spinal fluid of persons not suffering from sleeping sickness, and that in cases of "trypanosoma fever" —the disease described by Dutton—they could only be found in the blood. Two species

---

* *See*, however, Rabinowitsch and Kempner in C. B. XXXIV, No. 8, page 808.

of monkeys, as well as (to a less extent) rats and dogs, were found to be susceptible to the trypanosomes from cases of sleeping sickness and of trypanosoma fever, and in later experiments it was also found that monkeys inoculated with cerebro-spinal fluid from sleeping-sickness patients or with blood from cases of trypanosoma fever died with symptoms of sleeping sickness ; and *post-mortem* their brains presented the typical appearance met with in human beings dead of that disease. From the analogy with nagana it was suspected that in human trypanosomiasis a like mode of infection took place, and it was shown by experiment that a species of tsetse-fly (*Glossina palpalis*, Austen) after biting human beings suffering from trypanosomiasis could convey the disease to monkeys. It was also shown by an extensive series of observations that the distribution of sleeping sickness and of *Glossina palpalis* exactly correspond. From a letter recently received from Captain Greig it appears that morphologically and as regards their effects when injected into animals the trypanosome of the blood and that of the cerebro-spinal fluid are identical ; and five cases of trypanosoma fever were under observation with a view to ascertain whether the trypanosome present in the blood would ultimately be found in the cerebro-spinal fluid, and whether the cases would develop sleeping sickness. At the time of writing, in two of the cases the trypanosome had been found in the cerebro-spinal fluid, and in one of these cases early symptoms of sleeping sickness were apparently present. If the further investigations of the Commission confirm their previous work it may be concluded that, in all probability, sleeping sickness is caused by the entrance into the blood and thence into the cerebro-spinal fluid of a species of trypanosome (probably that described by Dutton) which is transmitted from the sick to the healthy by a species of tsetse-fly (*Glossina palpalis*) and by it alone.*

An important parasite.—In May, 1903, Major W. B. Leishman, R.A.M.C., reported the discovery of certain parasitic bodies, which, he suggested, might possibly be the remains of trypanosomes, in films taken *post-mortem* from the spleen of a soldier who had died from an anomalous type of fever apparently contracted in Dum Dum, near Calcutta. In the following July, Captain Donovan, I.M.S., announced that similar bodies had been found by him in blood obtained by splenic puncture from a number of patients suffering from enlargement of the spleen in Madras ; and in January 1904, Professor Marchand and Dr. Ledingham published an account of a case in which similar bodies had been found in sections of the spleen, liver, and bone marrow, obtained at the *post-mortem* examination of the body of a soldier who had apparently contracted his fatal illness in China. The parasites discovered by Captain Donovan were studied in films by Major Ross, I.M.S., and by Professors Laveran and Mesnil, and a difference of opinion exists between these authorities as to the exact zoological position of the parasites, for while Major Ross considers that they should be classed in an entirely new genus, Professors Laveran and Mesnil regard them as belonging to the genus *Piroplasma*. Further interest has been added to the subject by the publication of a paper by Dr. J. H. Wright, of Boston, in which a description is given of certain parasitic bodies obtained from a specimen of "Delhi Sore." These bodies were discovered by Surgeon-Major D. D. Cunningham, I.M.S., as long ago as 1885, and, so far as can be judged from the description and the excellent photographs in Dr. Wright's paper, they may be identical with the bodies discovered by Major Leishman.

As it appeared probable that Captain Donovan's discovery of the parasites in cases of enlargement of the spleen in Madras was likely to be of importance, Lieutenant Christophers, I.M.S., who was at that time on special duty in connection with malaria, was directed to proceed to Madras to investigate their nature. In a preliminary report,

---

* It would occupy too much space to give a complete bibliography of the subject here. Such a bibilography is contained in the article by Doflein and Prowazek on *Die pathogenen Protozoen* in Kolle and Wassarmann's *Handbuch der pathogenen Mikroorganizmen*. The following articles, which are easily accessible, may, however, be mentioned :—T. R. Lewis in S. C. I. for 1877 and in the Quarterly Journal of Microscopical Science, 1884, Vol. XXIV., pages 357 to 369 ; Vandyke Carter in Sc. Mem. by Med. Officers of the Army of India, Part III., 1887 ; Cunningham in the same ; Crookshank in the Journal of R. Microscop. Soc., Nov. 1886, page 913 ; Laveran and Mesnil in A.P. XV., 1901, page 673, and in A.P. XVI., 1902, page 1 ; Rouget in A.P.X., 1896, page 716. On page 189 of this volume will also be found an analysis of Bruce's preliminary report on nagana ; Elmassian and Migone in A. P. XVII., 1903, page 241. This article as well as others by Lignières, Sivori, and others, are reviewed in B.I.P. No. 1, pages 365–367. The literature regarding human trypanosomiasis is contained in the current numbers of the medical journals. A good summary and a complete bibliography since 1898 will be found in an article by Rabinowitsch and Kempner in C.B. XXXIV., No. 8. An article on sleeping sickness by Castellani in C.B. XXXV., No. 1, should also be consulted. Bruce and Nabarro's preliminary report is contained in the Royal Society's Reports of the Sleeping Sickness Commission, No. 2, August 1903, and the further report by Bruce, Nabarro and Greig in No. IV. of the same Reports, November 1903. The *résumé* in the text was written before the appearance of the paper by Schaudinn entitled "Generations und Wirtswechsel bei *Trypanosoma* und *Spirochæte*." Arbeiten aus dem Kaiserlichen Gesundheitsamte. Vol. XX., page 387.

Lieutenant Christophers gives a description of the parasites and of the clinical features and post mortem appearances of the cases in which they were found. It seems that they are essentially different from the malaria parasite and from parasites of the genus *Piroplasma*, in that they are never found in the red blood corpuscles. A most striking feature is their presence in large numbers in the leucocytes of the spleen and liver, and in addition to the usual kinds of leucocytes present in these organs there are found in cases of the disease numerous large cells resembling macrophages, packed with parasites. Some of these cells are very large and may contain as many as 250 parasites. Besides the liver and spleen, the parasites were found by Dr. Christophers in the red bone marrow, in the submucosa of the large intestine, in petechiæ from the arachnoid, in blood from the liver and portal vein, and in small numbers in blood from the spleen. They were never found in peripheral blood.

The bodies exhibit a remarkable uniformity in size and appearance. The majority are approximately circular in outline and about 2·5 micromillimetres in diameter, but some are larger and very much resemble a cockle-shell in shape. In stained specimens they are seen to possess two chromatin masses—a small one usually rod-shaped, and a large one which may be bilobed, or heart-shaped, or formed of two oval masses lying in contact.

An important discovery was the fact that ulceration of the large intestine is apparently a marked feature in all advanced cases, and that this ulceration is apparently produced by a process analogous with that which brings about the ulceration in cases of Delhi boil, viz., by the deposition in the submucosa of granulation tissue, which, after destroying the crypts and surface epithelium, undergoes necrosis and forms ulcers reaching as deep as the muscular coats. The parasites were present in large numbers in the mucous membrane and submucous tissue in the vicinity of the ulcers.

The clinical features of the cases in which the parasites were found were extremely characteristic. The cardinal signs given by Dr. Christophers are :—(1) great enlargement of the spleen, (2) emaciation, (3) irregular pyrexia, and (4) abdominal symptoms. The pyrexia and course of the disease are quite uninfluenced by quinine. In advanced cases diarrhœa and a dysenteric condition with blood and mucus in the stools are a constant feature, and death from peritonitis due to perforation occurred in two out of the three fatal cases which are described in the report. It is well known that cases presenting these clinical features are very common in India, and Dr. Christophers has no hesitation in saying that the cases of infection with this newly found parasite which were seen by him in Madras are clinically identical with cases usually diagnosed as "malarial cachexia with enlarged spleen." If this be so, the parasite will no doubt be found to be very widely distributed in this country, and a great advance in our knowledge of the Indian fevers will have been made. Until further work on the parasite has been done, it is impossible to assign to it a definite zoological position, and premature conclusions are much to be deprecated. That it does not belong to the genus *Piroplasma* appears to be amply proved by Dr. Christophers in his report, and at the present time the suggestion put forward by him, and independently by Wright, that the organisms seen in the characteristic large cells represent the spores of a *microsporidian* seems probably correct.

Pasteur Institute of India.—During the year ending 8th August, 1903, 584 patients were treated at the Pasteur Institute, Kasauli, as compared with 543 treated during the previous year. Of this number 269 were Europeans (207 men, 20 women, and 42 children), and 315 natives (255 men, 10 women, and 50 children).

The following tables exhibit the results among Europeans and natives respectively.

The tables do not include ten persons who presented themselves for treatment but were found not to require it, nor do they include four patients (three natives and one European) who developed hydrophobia during treatment, and two persons (both natives) who were attacked within 14 days after the completion of treatment.

On comparing the tables it will be seen that better results were obtained in the treatment of Europeans than of natives. The reasons assigned by Lieutenant-Colonel Semple for this were that the Europeans were less severely bitten, had their wounds more promptly and better attended to immediately after the bites, with few exceptions came earlier for treatment, were a healthier and stronger lot of people, and better fed before, during, and after treatment, and on this account were in a better position to become more highly immunised, and to offer more resistance to infection.

The small number of patients shown in class A (bitten by animals proved rabid) is attributed to the faulty condition in which the samples of brain or spinal cord from the animals which inflicted the bites were sent for diagnosis. Lieutenant-Colonel Semple

points out that for diagnostic purposes it is only necessary to send a small portion of either the brain, cord, or medulla in a small bottle of sterile neutral glycerine, and to do so as aseptically as circumstances will permit. Any other method of sending a sample of a "suspected rabid brain or cord" for diagnosis only results in putrefaction or destruction of the virus.

EUROPEANS.

CLASSES.	SUB-CLASS I. Bitten on the Head or Face.			SUB-CLASS II. Bitten through the exposed Skin on any part of the Body other than the Head or Face.			SUB-CLASS III. Bitten through the Clothing.			TOTALS.		
	Treated.	Failures.	Percentage of failures.	Treated.	Failures.	Percentage of failures.	Treated.	Failures.	Percentage of failures.	Treated.	Failures.	Percentage of failures.
CLASS A. Bitten by animals proved rabid	11	0	0	46	0	0	5	0	0	62	0	0
CLASS B. Bitten by animals certified rabid.	3	0	0	33	0	0	7	0	0	43	0	0
CLASS C. Bitten by animals suspected rabid.	12	0	0	114	0	0	38	0	0	164	0	0
Total	26	0	0	193	0	0	50	0	0	269	0	0

NATIVES.

CLASSES.	SUB-CLASS I. Bitten on the Head or Face.			SUB-CLASS II. Bitten through the exposed Skin on any part of the Body other than the Head or Face.			SUB-CLASS III. Bitten through the Clothing.			TOTALS.		
	Treated.	Failures.	Percentage of failures.	Treated.	Failures.	Percentage of failures.	Treated.	Failures.	Percentage of failures.	Treated.	Failures.	Percentage of failures.
CLASS A. Bitten by animals proved rabid	3	0	0	36	0	0	3	0	0	42	0	0
CLASS B. Bitten by animals certified rabid.	0	0	0	24	0	0	3	0	0	27	0	0
CLASS C. Bitten by animals suspected rabid.	13	2	15·3	201	4	1·9	32	0	0	246	6	2·43
Total	16	2	12·5	261	4	1·53	38	0	0	315	6	1·9

In badly bitten and late cases an anti-rabic serum, prepared at the Institute, has been used with good results as a preliminary to the usual methods of treatment. In these selected cases a dose of serum is given on the first day, after which the usual methods of treatment are carried out, commencing the day after the serum. The rationale of the method of treatment by anti-rabic serum is given by Lieutenant-Colonel Semple in the following words :—

> "In badly bitten and late cases the object of treatment is to confer a high degree of immunity as soon as we possibly can. An active immunity, such as is acquired by a patient who undergoes the usual method of treatment, takes a considerable time to accomplish ; but a passive immunity, such as is conveyed by using the serum of another animal which has been highly immunised, can be acquired very quickly. This state of passive immunity does not, however, last for long. It is easily acquired, but soon wears off again. My object in using the serum at all is to give badly bitten and late cases the benefits of this passive immunity, until they can be trained to acquire the more durable active immunity, which can only be acquired by undergoing a series of inoculations with rabid virus. In other words, the patient gets the benefit of the immune bodies contained in the anti-rabic serum given him, until he can be trained to prepare his own immune bodies."

In addition to the anti-rabic treatment, much general bacteriological work was carried out at the laboratory in connection with the diagnosis of enteric fever, Malta fever, malarial fever, plague, tubercle, diphtheria, &c.

One thousand nine hundred and twenty-five doses of typhoid vaccine were prepared and sent out between the 9th August 1902, and the end of January 1903.

Antivenene was prepared, and 1,020 bottles, each containing 15 c.c., were distributed for use all over India. "In a short time it will be possible to meet all demands in India for this serum."

Anthrax vaccine was prepared, and 560 doses sent out to applicants where outbreaks of anthrax had taken place. The preparation of diphtheria antitoxin and of tetanus antitoxin has also been commenced.

Scientific Memoirs.—Seven numbers of the new series of Scientific Memoirs by officers of the Medical and Sanitary Departments of the Government of India have been published and widely distributed, not only in India and in Great Britain, but to most of the universities and more important scientific libraries throughout the world. The two most recent numbers were the "First report of the anti-malarial operations at Mian Mir, 1901—1903," by Captain S. P. James, I.M.S., and "Some observations on the poison of the banded krait (*Bungarus fasciatus*)," by Captain G. Lamb, I.M.S. Early numbers will contain the preliminary report by Lieutenant Christophers, I.M.S., on a parasite found in persons suffering from enlargement of the spleen in India, and by the same officer, the "Second report of the anti-malarial operations at Mian Mir," which is a continuation of the first report already mentioned.

18309

ABSTRACT OF THE REPORT OF THE SANITARY COMMISSIONER FOR MADRAS FOR 1902.

(*Lieutenant-Colonel W. G. King, C.I.E., I.M.S.*)

General Population.

The population under registration during the year was 36,331,518,* against 38,252,900* of the Census population of the Presidency, and 38,744,900* of the estimated population for the period. As usual in a fairly prosperous year, emigration declined; there being a total of 58,782 less departures than in the previous year. Immigrants exceeded emigrants by 47,505.

It has repeatedly been pointed out in the Annual Reports of this office that the necessity for including statistics received from areas under Zamindars, whose village officials are not subject to the same grade of discipline as those under Collectors, vitiated results. Government therefore directed that Collectors should supply two sets of monthly statistical returns, in one of which zamindari areas should be eliminated, so as to test this fact. The result has been to show that parts of districts under revenue control afford decidedly better registration results than those under zamindari rule.

Births in Districts.—A total of 1,023,146 births was registered during the year. This represents a birth-rate of 28·2 per 1,000, or an improvement of 3·1 per 1,000 compared with last year. This increase must, in chief part, be ascribed to the influence of cheaper food-grains, as although doubtless year by year increased attention is being paid to registration, this could have had but little effect, seeing that, although the birth-rate has improved, it has not yet so far recovered from the depressing influences (detailed in my preceding report) to which it had been subjected as to reach even the average figures for the five preceding years. Indeed, it cannot be accepted that full results can be exhibited until the statistics for 1903 are gathered. It will then be of interest to ascertain how far those districts that chiefly suffered from high prices have undergone rapid increase of population, which is the natural sequence of a temporary depression of the nature indicated. In the meantime, it is noteworthy that of the districts stated in last year's report to have had particularly poor birth-rates, namely, Chingleput, North Arcot, Kistna, Madras and Kurnool, there is in each case exhibited a greater rate of increase than in other districts, if Madras be excepted. Both in Madras and Anantapur, a falling off from last year's poor birth-rate has occurred. As to Anantapur, the difference is small enough to be compatible with less careful registration by village heads, probably owing to the additional work in connection with plague. As to Madras, it may be accepted that no relaxation of registration efforts has occurred, and that consequently the still unarrested decline of births may be due to disturbance of the already disproportionate population of males and females during the continuance of high prices, which was not sufficiently recovered from during the short period available in the year under review. However this may be, it is necessary that the possibility of relaxation of vigilance as to registration in the City of Madras be considered by the authorities concerned.

Deaths in Districts.—The death-rate for the districts as a whole in 1902 was 20·2 per 1,000, against 21·3 per 1,000 in 1901. That the decline in the death-rate is not due to increasing imperfection in registration may be accepted, when it is remembered that the birth-rate obtained from statistics gathered from the same agency has shown a marked increase. The diminished rate is chiefly accounted for under cholera. If the epidemic diseases cholera, small-pox and plague be eliminated from the statistics of both years, the

* Inclusive of Europeans and Eurasians.

death-rate from ordinary causes was 18·4 per 1,000 in 1902—the same rate as obtained in 1901. Whilst the total average rate for the Presidency shows the decline stated, the following six districts exhibit rates above those of the preceding year :—Bellary (8·9), Madura (5·4), The Nilgiris (5·6), South Arcot (1·9), Tanjore (1·3), and Tinnevelly (3·5). In the last two districts the increased mortality was due to cholera, and in the first to plague.

Births in Municipalities.—There are now 61 towns under municipal rule in this Presidency, where compulsory registration of births and deaths is enforced by the employment of special staffs. These towns contain an aggregate population of 2,422,121. The total births for the year being 78,599, the birth-rate was 32·7 per 1,000—an advance of 0·1 per 1,000 on the previous years. It will be noted, in reference to prices of food-grains, that the fluctuation in birth-rates exhibited by the rural population is not evident amongst the inhabitants of the municipal towns which, as suggested by me last year, will go to show that the past pressure of prices was chiefly felt by the lowest class of the agricultural population. The marked decrease in the Bellary rate is ascribable to desertion of large portions of the town during the existence of plague, and the same reason is applicable to Adóni, Walajapet, and Mangalore. Seeing that, as established by Messrs. Stokes, Hardy, and Stuart (Madras Census Commissioners of different periods), the normal birth-rate in this Presidency must be somewhere between 42·45, 53, and 52 per 1,000, the decline of the birth-rate, when compared with the previous year (in which it had by no means approached the normal) of more than 2 per 1,000 in the case of Madura, Ongole, Karúr, Chidambaram, Kumbakónam, Máyavaram, Negapatam, Tinnevelly, and Palamcottah, must be the result of absence of active supervision of the collection of vital statistics by the respective councils. Several municipal councils persist in employing too few men for the work of registration. They are frequently very badly paid and badly educated. The rate of 25·4 per 1,000 for Negapatam is manifestly incorrect, even when compared with the poor results of other towns in the same district, and notwithstanding a slight intercensal decrease of population as ascertained from the census of 1901.

Deaths in Municipalities.—The total death-rate of municipal towns shows a decrease of 2·9 per 1,000, when compared with the past year. The decline is chiefly under the head of cholera and fevers. Excepting plague-infected towns, Madras City heads the list of mortality with a rate of 42·4 per 1,000. This, with a birth-rate of but 34·9 per 1,000, shows that this town depends for its existence upon immigrants. The rate, however, is a considerable improvement upon that of 55·5 at which it stood last year. The significance of recorded rates quoted for the Madras City can, however, only be correctly appreciated by remembering that the proportion of males and females and of persons at "useful ages" differs from that obtaining in the average municipality of the mufassal. Thus, I showed some time back (Administration Report for 1893) that a recorded death-rate for Madras of 40·47 per 1,000 really meant, when corrected for age and constitution of population according to the standard obtained from 23 fairly representative municipalities, a rate of 43·45 per 1,000.

The heavy death-rates recorded for Bellary, Adóni, Vániyambádi, and Mangalore are due to the existence of plague, and those of Ellore, Tuticorin, and Tinnevelly to the presence of cholera during the year. The satisfactory decline of the death-rates of Cochin and Berhampur, when compared with the preceding year, followed the absence of cholera. In regard to Vániyambádi, it will be noticed that, whilst its death-rate is 128·9, the birth-rate is recorded as 63·1. This town is largely composed of Muhammadans, who are much married and maintain considerable zenanas. The rate may therefore be correct, but, if so, it is singular that the partial evacuation of the town two years in succession owing to plague has not exhibited more influence. At any rate, the veracity of the statistics will be specially enquired into.

The infantile death-rate in municipal areas was 233·3 per 1,000 of recorded births, against 237·3 during the previous year. The former figure represents a decline of 4 per 1,000, which must be regarded as satisfactory, and is probably the response to removal of the indirect influences of high prices of food-grains. Still, the heavy death-rate contrasts markedly with that found in rural areas, namely, 168 per 1,000. As both rates are reckoned upon total registered births, there is no more likelihood of mistakes as to one than the other, and it will be observed the proportion of male to female deaths, namely, 100 to 90·2 in rural areas and 90·16 in municipal areas, shows no very special difference. There is thus room to believe that both rates fairly represent facts as found. According to a standard formed by me from analysis of statistics of 23 fairly healthy

towns, it may be taken that the death-rate of infants ought not, under average insanitary conditions of this Presidency, to exceed 176·25 per 1,000 of births. Consequently, there should be no difference of opinion that in towns exhibiting a death-rate of infants of over 250 per 1,000, there is some specially inimical influence at work. These are Guntúr, Bezwada, Ongole, Madras, Chidambaram, Negapatam, Madura, Tuticorin, Tirupati, Coimbatore, and Karúr.

In regard to Guntúr, the death-rate of infants has long been persistently high. On making enquiries as to the causation, I have hitherto received no satisfactory reply. The cause of death as registered in Guntúr is largely "Convulsions,"* but, as this is usually the heading under which deaths of infants are placed by lay registrars, this nomenclature conveys no information. Sanitary enquiry in such a matter must be preceded by a collection of medical facts, so as to secure some guidance as to the direction the enquiry should take. Arrangements will be made for a special investigation of this nature. In regard to other towns having this heavy rate, the majority possess high sub-soil water levels, unusually foul soils, and are overcrowded—all well-recognized factors influencing the infantile death-rate. Much of the death-rate is, of course, due to ignorance of domestic hygiene and nursing, and I am therefore glad to be able to state that at least one member of the educational department (Mrs. Brander, Inspectress of Schools) is making a speciality of the spread of knowledge on such matters by means of publications. That Dindigul should have an infantile death-rate of 89·6 is certainly not due to particular regard of sanitation by the Municipal Council, but to the more prosaic fact of absence of care as to registration.

So far as age at death is concerned statistics show that from 5 to 9, and 10 to 14, there is little difference in the death-rate of sexes, but that the influence of child-bearing establishes itself at the early age of 15 to 19 ; as might be expected in this country, having regard to nature of marriage customs.

Chief Diseases.

Cholera.—A total of 29,769 deaths have occurred from cholera. This represents 4·1 per cent. of the total mortality of the Presidency and a rate of 0·8 per 1000 of the population. 15,782 of these deaths were of males and 13,987 of females, a disproportion that would seem to indicate a special tendency for the male to contract cholera. When, however, the rate is applied to the respective populations of the sexes, it is found that the incidence is but 0·9 in the case of males and 0·8 in the case of females. The same line of reasoning occasionally leads to the belief that adults are more liable to be affected with cholera than the very old or the very young. But statistics scrutinized by me some time back show that in this Presidency, if the incidence be calculated upon, the populations of the respective ages, all ages are practically equally liable to attack—not even excepting infants of one year of age, who it must be remembered are generally fed with little hygienic care.

In regard to the incidence upon various districts, as usual, the statistics show that it is greater during the period of the monsoon which chiefly affects the district concerned. Thus, during the year in the south-west monsoon districts the incidence during that monsoon upon the population was 0·36 per 1000, and during the north-east monsoon was but 0·11 per 1000 ; whereas, in the north-west monsoon districts, the incidence during that monsoon was 0·17 per 1000, and during the south-west monsoon only 0·14 per 1000.

The so-called municipal cholera rules (Government Order No. 1536 M., dated 9th September, 1896) adopted by 24 municipalities, require that directly a town is "imminently threatened" with cholera, it should be warned, and that a definite staff should be added to the permanent staff for observation purposes, and if a town be actually attacked that to this be added a preventive staff. In the remaining municipalities, although the rules are not compulsory, no opportunity is lost by this office to impress them with the necessity of following the rules, as far as their funds will permit. Practically, therefore, the difference between two sets of municipal towns lies between the more and less complete adoption of the rules. Nevertheless this year, the difference of incidence of cholera although small is in favour—the mortality being ·1 per 1000 less —of those adopting the rules as a compulsory measure. During the year, the towns of Chidambaram, Cuddalore, Tiruvannámalai and Ellore, representing an aggregate population of 122,715, were added to the list of those adopting the rules.

* Of children under ten years of age, Municipal Registrars show 7·3 per cent. of the total death as due to "Convulsions.

In rural areas so late as 12 years back, it was no uncommon matter to find that the total sanitary arrangement made to combat cholera by local authorities was the deputing of vaccinators—who, by some occult reasoning, were regarded as possessed of sanitary or medical abilities, for the purpose of distributing cholera pills. Further back, I remember as Special Sanitary Officer of the Town of Madras during the epidemic of 1882, finding that disinfection meant distribution of sticks of sulphur to peons, who handed them to the owners of infected houses, who duly burnt them in their verandahs. Now-a-days in rural areas Certificated Sanitary Inspectors look to such matters and slowly—very slowly—synchronously with the dawning belief that sanitation may not deal solely with fads—these men are displacing untrained Conservancy Overseers, or Hospital Assistants who are erroneously expected to medically treat patients, and yet rush from village to village to tend sanitary matters. Moreover, considerable attention has been paid to water-supply in the larger towns, and some slight advance has been made in the same respect in rural areas. Can then the effect of such efforts be measured in figures? Admitting at once that epidemics of cholera in one decade might be more virulent than in another and therefore leaving the figures open to question, I would state that an improvement as to less incidence would seem to be exhibited by the fact that in the decades ending 1882 and 1892, the incidence of cholera was 2·7 and 2·7 respectively, but in that ending 1902, it was 2·0. The saving of life in the third decade would therefore amount to 258,756.

In respect to the efficacy of treatment by permanganate of potash of waters supposed to be contaminated with the cholera microbe, the opinions of District Medical and Sanitary Officers still remain much divided. Acting on the suggestion of the Army Sanitary Commission, by order of Government, I circulated to all District Medical and Sanitary Officers directions for the gathering of specimens of such waters for the purpose of being bacteriologically examined by me, in reference to the possible presence of cholera microbes in a living condition, before and after treatment of the water by permanganate of potash. Although this was issued in November, 1902, no specimens of contaminated water have yet reached me for examination.

Small-pox.—The incidence of small-pox on the population of the whole Presidency was the same as in the former year, namely, ·7 per 1000. In the districts of Malabar, North Arcot, and Bellary, the incidence was 2, 1·2, and 1·1 per 1,000, respectively. In the case of the district of Malabar, there can be no doubt that much attention is still required to the prophylactic operation of vaccination, and various efforts have of late years been made in this direction. The advance unfortunately must be slow, as Moplahs are not yet convinced that this precautionary measure of vaccination is not an attempt to cheat fate. But that advance has been made is evident from perusal of the following figures, showing the annual death-rates per 1,000 under the head of small-pox during the last ten years :—

1892...	4·4	1897...	0·01
1893...	4·6	1898...	0·04
1894...	1·3	1899...	0·05
1895...	0·03	1900...	0·2
1896...	0·1	1901...	0·8

In regard to municipalities, the total incidence upon the population was 0·8 per 1,000, against 0·6 per 1,000 of the previous year. Of the total of 2,041 cases, no less than 1,043 were contributed by three Malabar municipalities, namely, Calicut (667), Cochin (100), and Cannanore (276). In municipalities, the average age incidence under one year was 2·7 per 1,000, and between the ages of 1 and 10, 0·69 per 1,000; whereas, in rural areas, it was 8·1 and 0·7, respectively, showing the better protection obtained with the compulsion used in municipalities, and the folly in both areas of delaying vaccination till the child is six months old.

Compulsory clauses as to vaccination of the Local Fund Act were extended to 118 unions during the year. In the present state of organisation of the vaccination staff for the Presidency,* it is, however, not possible for full advantage to be taken of compulsion in these areas. During the year, the Inspector-General of Prisons forwarded an interesting communication showing steady decrease in the number of prisoners arriving at jails "unprotected," namely, 23·9 per cent., 21·7 per cent., and 13·9 per cent., respectively, in the years 1899, 1900, and 1901. As the figures concern average representatives of the uneducated classes of the community, the extent to which protection exists amongst adults may be thus fairly well gauged. Taking successive

* Government contemplates reorganisation.

decades into account, as in the case of cholera, it is found that the very small expenditure on the Vaccination Department is justified by the following figures:—In the decade ending 1882, the small-pox mortality was 1·9 per 1,000; in that ending 1892, 1·4; and in that ending 1902, 0·3. The saving of life during the last two decades has amounted, therefore, to 572,980.

Respiratory Diseases.—Under this heading are grouped figures that doubtless by no means represent even an approach to truth, as the capacity of ordinary village officials to ascertain whether fever arises from an affection of the chest must be very little. What for some years probably will be gathered are instances of asthma, chronic bronchitis and phthisis, whilst acute affections of the pleura and pneumonia will be, as heretofore, placed under "fevers." Nevertheless, an attempt at differentiation is advisable, and should be persevered with. As reported by districts, the total deaths from respiratory diseases amounted to 0·1 per 1,000 of the population. There was nothing to indicate that the presence of plague induced registration (with reference to pneumonic plague) under "respiratory diseases." As ascertained, the mortality during 1902 under this head in municipalities was 1·4 per 1,000.

Plague.—During the year 10,795 deaths from plague were registered. 10,770 of these occurred in the districts of Anantapur (89), Bellary (7,354), Coimbatore (496), Kurnool (56), North Arcot (114), Salem (1,668), and South Canara (993), parts of which were indigenously affected. The territory under the Government of Mysore continued to form a special danger to this Presidency, in that beyond measures in the cities of Mysore and Bangalore very little attempt at organisation for checking the spread of the disease exists in that area. Some indication that the Mysore Government might arrange a mutual scheme for the protection of the respective frontier districts was perceptible, but nothing definite has been done up to date. So long as Madras territory is liable to be repeatedly invaded from an area where no organisation exists, the chances of successful resistance to the general spread over the whole Presidency are much lessened.

The municipal towns indigenously infected were Adóni, Bellary, Mangalore, Tiruppattúr, and Vániyambádi. The last-mentioned town has been a source of constant danger to surrounding areas, owing to the obstructiveness of the population.

No material change was made in the policy pursued by Government which may be said to be a system of surveillance, without detention, of all travellers passing from infected areas (whether these be within or without the Presidency) to uninfected areas so arranged that to whatever part of the Madras Presidency they journey, surveillance proceeds uninterruptedly for a period of ten days. As the people of this Presidency are generally better educated than elsewhere in India, this mild measure has been received in a sensible manner, and is fairly efficient. So far as can be judged, it has certainly been possible to detect the majority of imported cases, and numerous localities have been spared thereby from becoming indigenously infected. Where rural areas are "imminently threatened" by plague, special staffs composed of Certificated Sanitary Inspectors (or, when the supply of this class of men is insufficient, by those known as Temporary Sanitary Inspectors, who have been trained and have undergone examination solely with reference to plague work) are placed on duty, so as to strengthen the executive of the existing district staffs, and thus keep each inhabited area under systematic observation. These staffs are further strengthened by so-called preventive staffs, on attacks occurring in any area. In the municipal towns, also, special staffs for observation and prevention are organised. It has been the constant endeavour of Government to require local authorities to employ sufficient staffs to detect cases the moment they are imported and to take prompt means to prevent spread, instead of waiting till plague gets hold of an area and then making an effort.* Railway inspection has been used only where it is possible to protect a still uninfected area. As thus interpreted, railway inspection is efficacious. Thus, during the year, 176 cases of plague were withdrawn from the railway trains at Jalarpet, the point where cases from the Mysore territory are received.

If it be understood that by the means thus roughly indicated, it has been possible to trace the origin and progress of epidemics with greater accuracy than in areas where such

* Dr. R. Bruce Low, in his recent Report to the Local Government Board of England as to progress of plague and measures adopted in various countries, states, in reference to Madras,—"It is somewhat surprising to find that as yet, comparatively speaking, plague has hardly gained a foothold in this Presidency." I think this putting off of the, perhaps, ultimately inevitable defeat before advance of plague, may fairly be ascribed to the rigid adherence to this policy by the Madras Government, notwithstanding the receipt by it of much conflicting evidence and varying counsels.

means are not adopted, it may be accepted that experience in this Presidency shows that man causes the rat to suffer and not the rat man in the first place, that the area over which infected rats roam is usually small, and that recrudescence is by no means a natural feature of the disease, but a very natural result of apathy or too optimistic treatment of an indigenously infected area. Blind belief in this theory of recrudescence, when coupled with the theory of soil contamination, has trammelled all sanitary measures in India. If I am right, energetic application of sanitary measures during decline of the disease in the hot season is of much more value, and the possibility of stamping it out is much greater than usually held. Prolonged vitality of the plague microbe on the soil or its retention of vitality at any material depth, is probably a myth, and, if so, plague policy could be much modified. The amount of information placed at disposal of sanitarians by bacteriologists on this most important subject is meagre in the extreme. Members of the Indian Plague Commission commenced work in this connection, but had to leave the country before it was complete. I am perfectly aware of the difficulties presented to the bacteriologist in working in soil with the plague microbe, but a definite enquiry on lines required by the sanitarian would be worth many lakhs of rupees to the country, and it would be well worth while offering bacteriologists a substantial honorarium for the best investigation on the subject.

Fevers.—The mortality under the head of fevers was in districts 7·7 per 1000 against 7·9, and in municipalities 6·7 against 8·2 in the previous year. The mortality in the Madras town decreased from 18·3 to 14·7 per 1000, which figure however left it possessed of the highest rate in urban areas in the Presidency; the next in order being Kurnool and Nandyal—both notoriously malarious towns. In the absence of registration supported by medical diagnosis, it is, of course, impossible to ascertain what proportion of fevers in Madras town are due to malaria or to typhoid, and other possibly unnamed fevers. But that fevers of a truly malarial character exist in Madras has been long established, although Captain James, I.M.S., has shown that these are not of so severe a type as was perhaps imagined. The question of malaria in Cuddapah has long been under discussion, and measures towards improvement by relief of surface and sub-soil drainage have frequently been considered. The Council is at present discussing the question of limiting the wet cultivation. This undoubtedly acted beneficially in the case of Kurnool, where the municipality under my advice, in 1881, secured a zone of one mile radius from the town free of wet cultivation. Much abatement of fever occurred after the enforcement of the order; but of late years owing to gradual encroachment within the defined area, malarial fever has been more evident. Greater strictness during the past year with reference to this zone has apparently been beneficial, as shown by the decline of the fever rate from 16·0 to 11·2. This town and a large tract of country neighbouring the Kurnool-Cuddapah canal, which were formerly healthy, were undoubtedly rendered malarious after the introduction of the canal, and the irrigation and leakage which occurred therefrom. A similar instance of the influence of canals upon the health of surrounding areas was investigated by me during the year. Ennur was long a favourite health resort for the people of Madras, before railway facilities to the Nilgiris existed. It was, however, about 1896 attacked with what was popularly held to be a mysterious fever, which, however, at that time was shown by me microscopically to be malarial, and was assigned by me provisionally to physical changes, which I have now been able to confirm. Called away from that work by more urgent duty, I was not able to re-visit the place till 1902, by which time it had been already examined on a more scientific basis, in accordance with present day doctrines, by the Malaria Commission. I found that from Ennur or more properly speaking from Black Town, Madras, up to Muthkur in the Nellore district, there are grades of malaria amongst the population that are at times intense. Without entering into details in this report, I would state that the change in the health condition of this long tract of coast line followed definitely alterations in the structure of the Buckingham Canal, more especially with reference to insertions of locks affecting sub-soil water level, and points of exit of and obstruction to, the surface drainage. Whilst these conditions were being established, changes of configuration of the coast line in certain spots, owing to the action of the Madras Harbour, accentuated results in particular localities. In the case of Ennur, these circumstances were accentuated by extensive embankments due to the railway crossing the back water, and obstructing tidal action. With this was conjoined the possibility of introduction of men bearing malaria, amongst the large number of railway workmen who were assembled. The total result has been an elevation of the sub-soil water in certain areas and the collection of surface water in others, so that the mosquito has been placed under favouring conditions towards multiplication. At any

rate, statistics show that on the east side of the canal where these changes would naturally be most evident, fever has increased out of all proportion to villages on the opposite side. In the portion of the canal extending towards Sadras southwards, no radical changes in structure of the canal took place, nor has there been any increase of fever. So far as the mosquito is concerned, the difference between the two areas found was that, whilst following the course of the canal through Madras to Sadras, the anopheles of Ross (so far as my examination extended solely) was in evidence, the anopheles culifacies and anopheles fuliginosus—the latter more particularly in Tiruvattiyur—were found at intervals. Both these, according to the Malaria Commission, are specifically malaria-bearing compared with the feebly malaria-bearing anopheles of Ross. In this connection, I may state that in the notoriously malarious town of Kurnool during the height of the hot season, I failed to find any anopheles larvæ except a few of the Ross species in pools formed by the waste from public water-supply ; whereas in the village of Dhone in the same district, 30 miles distant from it, in the cold season, I found no lack of anopheles, certain of which do not fit into the character of hitherto described species. Here also the malignant tertian parasite is to be found, whilst along the coast the quartan was in evidence. At Nandyal, I found a single specimen of mosquito that much resembles the anopheles Lutzii, which is said to be an inhabitant of Brazil. It had, however, the distinguishing characteristic of having no ornamental markings on the dorsum of the thorax, and had one very narrow band on its otherwise black palpi.

In Tuticorin, the question arose as to whether certain cases of fever among Europeans was of a malarial or typhoid nature, especially in reference to the supposed evil influence of dredging of the harbour. Malarial fever undoubtedly exists in the town, as well as the anopheles culifacies. The only European however available for examination who had suffered from the fever was the one to whom alone Civil Surgeon Oosman, who had forwarded an able report to me on the subject of the outbreak, was inclined to admit true typhoid symptoms. In this case, I carried out Widal's test and secured a confirmatory reaction. As to the source of infection in this instance, the possibilities were so extensive in connection with highly insanitary milk and water-supplies that it was not feasible to identify the actual cause. The chief fact of importance established was simply that typhoid infection really was contracted in the locality. It was quite evident to me that the European residents ran considerable risks of contracting typhoid not from the foul smelling dredgings of which they complained, but from extensive defœcation by natives which occurred along the front of the beach, in the neighbourhood of their offices. The eating of a cold luncheon in houses where flies and dust could deposit the microbe certainly was the most obvious but unproved factor, having regard to the history of the remaining cases.

In connection with typhoid, Lieutenant-Colonel Sanjana, District Medical and Sanitary Officer of South Canara, has communicated to me statistics which show that typhoid fever was got rid of in the Mangalore Jail subsequent to the introduction of Berkefeld filter plant. Unfortunately, the true significance of the fact is minimized by boiled water having been introduced for drinking purposes during the same period. Yet, the only case of typhoid, which occurred after the period of the introduction of the filter, followed within three weeks of its damage and temporary disuse.

Dysentery and Diarrhœa.—In districts, the total rate per 1,000 of mortality from this cause was 1·0 against 1·1 of the previous year. In municipalities, the rate was 4·5 per 1,000 against 5 of the preceding year. The towns making the heaviest returns under this head were Conjeeveram, Chingleput, Rajahmundry, Madras, Periyakulam, Gudiyattam, Tiruvannamalai, Tinnevelly, Palamcottah, Tuticorin and Vizianagram. It would be an easy matter to say that these towns are notorious for evil water-supplies, and that they have foul soils. But if the case of Conjeeveram be considered, it will be found that it is now supposed to have a sound public water-supply, whereas Chingleput in the same district is not so supplied, and similarly suffers. The truth is, as might be expected from the nature of the disease, that whilst a pure water-supply will aid in prevention, it cannot get over the further difficulty of a badly conserved soil from which must be distributed, by dust and the agency of flies, the causative agents of dysentery and diarrhœa. Persumably, also, certain soils are more conducive to the retention of the causative agent than others. Thus, in the attached nosographical map, it will be found that the chief diseases of the Chingleput district are diarrhœa and dysentery, and its two municipalities form no exemption to liability. Perhaps, in tracing out such matters in detail, it would be possible to show that foul areas with high sub-soil water levels suffer more than those where these conjoined conditions do not exist.

Injuries.—A total of 13,032 deaths from injuries was registered, yielding 0·4 per 1,000 of the population. This represents an advance of 0·1 per 1,000 upon the rate (0·3) which has been returned in seven years of the last decade. This little variability implies that, up-to-date, the population is not largely subject to the various influences of extensive manufactures, mining, shipping and other strenuous endeavours, owing to chief dependence upon agricultural methods. Suicides are included under this head. There was a total of 1,646 against 1,672 of last year. As usual, and in contrast with European countries, suicide of females was in greater proportion to males, namely, 100 to 87·3.

All other causes.—45·7 per cent. of the total causes of death was registered under this head. It can hardly be expected under such conditions of registration that any refinement of sanitary efforts should be possible. It may be argued that, having regard to the difficulty of securing funds for sanitary work in this country, it is possible that there is an already sufficiently large field open to the sanitarian to deal with various diseases classed (albeit somewhat erroneously) under existing heads of registration. But, it is also true that such funds as are available can be used to the best advantage by their being spent for the eradication of diseases definitely located—sanitation is of real utility only when it "touches the spot."

Sanitary Works.

Municipalities.—As stated in my last year's report, a condition of stagnation has overtaken municipal efforts, following the announcement by the Government of India that free grants would no longer be taken in aid of major sanitary engineering works. I am not in a position to judge of the resources of other local bodies in India. But of this I am perfectly certain that the demands on the purse of both municipal and local fund boards in this Presidency are more numerous than in other parts of India, and consequently there is not that elasticity of funds which will permit of the amounts of money required for large sanitary works being obtained in the local market, without some form of monetary aid or guarantee from Government. Tanjore still advertises in vain for a sum of £2,200 to safely dispose of its sewage on a farm that would be highly remunerative! In the meantime, under arrangements formerly existing, Vizagapatam has the benefit this year of receiving its water-supply, and the works for Cocanada are approaching completion. The great City of Madras still depends upon works that distribute, at inefficient pressure, water that has been incompletely protected and is unfiltered, and, with insufficient funds, is attempting to obtain some relief to its sewage soaked soil by its usual expedient of incomplete sewage works. The work of opening up its congested areas remains untouched. Madras is, at this date, a standing illustration of the sanitary inutility and wastefulness of economical and patchwork sanitation. Rajahmundry has at last taken into consideration a scheme I pressed upon it some years back, of opening up an extraordinarily congested and insanitary area in the neighbourhood of Wadi Street. Bellary has proposals of the same character. Negapatam is looking for funds to open up an extremely congested and filthy quarter, and to utilizing the open ground so gained for the erection of a market.

As regards the influence upon fever of the introduction of water-supply when, for reasons stated in my last year's report, statistics are collected for towns where the water-supply is fairly completely distributed, it is found that the total death-rate and the death-rate from fevers have undergone diminution. Thus, in the six towns having an aggregate population of 280,979 for five years prior to the introduction of water-supply, the total death-rate was 30·4, and for the five years ending 1902 after introduction of the water-supplies, it was 26·6 per 1,000; whilst the average death-rate from fever was 8·9 and 4·8 per 1,000 for the same periods, respectively. In contrast with this, in 17 towns without water-supply having an aggregate population of 754,034, the total average death-rate for five years ending 1897 was 27·7; whereas in five years ending 1902, it had increased to 28·1 per 1,000. In the same periods, the average death-rate for fever was 6·5 and 5·8 per 1,000 respectively.

As regards the influence upon cholera of protected public water-supplies in the towns referred to in the preceding paragraph—whilst during the five years previous to introduction of water-supply the death-rate per 1,000 from this cause was 4·1, it was during the five years ending 1902 reduced to 1·8 per 1,000. A further illustration of the influence of water with reference to the spread of cholera is afforded by statistics supplied to me by Lieutenant-Colonel Hakim, District Medical and Sanitary Officer, Trichinopoly. He showed that in that town the incidence of cholera fluctuated according as the public water-works were in a position to give water or not to the town. In 1894, I caused statistics to be prepared that showed very clearly that the Cauvery was a dangerous source of

water-supply, during the prevalence of cholera, from the Coimbatore district down to its outlet. The frequent interruptions in regular working to which the Trichinopoly water-works have been subjected, owing to a series of accidents, seemed to me to afford an opportunity of further elucidating this fact. When in correct order, the works supply the town with water that is derived from an infiltration well placed in the sandy bed of the river Cauvery, and when the connection with this has from time to time got out of order, water direct from the flow of the river was pumped to the town without treatment or filtration. I am by no means a believer in infiltration wells of this nature, as affording anything like the same measure of safety as ordinary slow sand filter beds. Still, that a considerable grade of protection from the cholera microbe is so secured seemed evident from the statistics obtainable. I therefore called for further information. The facts need not here be detailed, but they give clear proof (and it must be remembered the interruptions occurred in various months in several years) that Trichinopoly was very much more free from cholera during those periods when water from the river sub-stream, by medium of the infiltration well, was supplied to the inhabitants than when Cauvery water was obtained from the surface flow direct.

During the year, Government invited the Municipality of Madras to undertake an experiment advised by me to prove that if sewage must find its way into the Cooum, it should do so after filtration, and that under such circumstances it would no longer be a nuisance. Although two consultations were held by me with the Health Officer on the subject and a definite scheme was determined upon, no progress was made on the subject. In the meantime, Government has sanctioned the erection of bacterial filters in connection with the Vaccine Institute, where will be carried out experiments that will determine whether the claim made at Poona that the manurial properties of filtrates of sewage are so infinitely more valuable than crude sewage when applied to land direct, that it will pay to make special works to cause sewage to reach land already completely biologically treated, is really correct. The question is one of considerable importance to agriculture, and is one that will react in favour of the correct disposal of sewage in both urban and rural areas, if there be any solid foundation for the premiss, concerning which I confess myself to be sceptical. Bezwada which had erected some years back rough bacterial filters is still in the position of hoping to obtain a plot of suitable land. Kumbakonam already uses a part of the filtrate of its sewage on cultivated land. The appointment of a Certificated Sanitary Inspector as Secretary to the Salem Municipality has led, amongst other minor sanitary improvements, to the accomplishment of a small scheme, which I had suggested in vain in previous years, for diverting sewage to a bacterial filter, that formerly was received untreated into a river whose connection with cholera spread is notorious. The principle of the bacterial filter is gradually replacing cesspools in towns, in the form of filter-pits, filter-trenches and household sewage filters. Filter trenches used as latrines, when conjoined with hand removal of fœcal matter from the sand surface, have been proved at Periyakulam to afford a cleanly and cheap mode of disposal of urine and ablution water. Sewage farms or sewage gardens continue to be employed with success in Madras, Negapatam, Rajahmundry, Karur, and Guntur. Cropping over night-soil trenches, more especially with the object of inviting attention of ryots to the utility of night-soil is pursued in Erode, Cocanada, Rajahmundry and Palni.

I think steady, though slow, improvement is being made in the important matter of conservancy of towns, by the paying of better attention to the character of the latrines and plant for the removal of night-soil and rubbish. This, amongst other practical results, I consider is largely due to the influence of Certificated Sanitary Inspectors, who now, to the extent of 110, occupy places in municipalities formerly filled by men who had no training whatsoever in sanitation. It is frequently held by those who forget if money is spent at all, it should be spent on recognized principles where sanitation is concerned, that the possession of Certificated Sanitary Inspectors has implied an extension of cost on account of salaries out of proportion to results, and that the old and cheap type of men who were simply drivers of conservancy coolies was sufficient for requirements—the "good enough" policy. As a fact, however, whilst I have urged that municipalities should possess trained men, I have as consistently advised Government to require them to get rid of the numerous petty posts on small pay for which there was a constant predilection. As a result, certain of our larger towns spend less, and the majority but very slightly more, upon their supervising sanitary staff to-day than they did in 1891.

District Boards.—Improvements effected by District Boards are not of a nature that can be demonstrated on paper to have much influence on the course of sanitation. So long as the present organization of local fund bodies exists, whereby petty sums are distributed to

numerous petty bodies, it is not possible that any substantial improvements can be secured. Nevertheless, progress has doubtless been made in minor improvements, such as repairs to wells, improvements to tanks, erection of latrines, slaughter-houses and the like. During the year 34 Certificated Sanitary Inspectors were entertained by the district boards, representing one Certificated Sanitary Inspector for every 4,000 square miles under the administration of these bodies. These new functionaries have been received amongst certain district officials with very much of the conservatism and prejudice with which a new shaped hat or a new fangled rifle, is usually accepted by the British Army. As an illustration of this conservatism, I would state that a report, which reached me during the year, of a fair and festival at which 13,000 people had assembled, bore the recommendation by the reporting officer that a sanitary establishment should be employed in future years, there having been neither arrangements for protection of water-supply nor conservancy, nor as to any other detail in connection with sanitation ; although in former years, under like circumstances, cholera had been epidemic at this festival. The remark of the civil officer responsible was laconic, but to the point. It was contained in the single word—"rubbish." Conceived in the same absence of appreciation of sanitation was the objection of a municipal council, also received during the year, concerning the adoption of a pump or lift, in lieu of allowing the people to withdraw water direct—involving the dipping of chatties, hands and feet—from an important water source ; they held that if machinery were used it would "infuse in the water a strong iron or copper smell"—dirty hands and filthy feet were not to be compared to this risk ! Nevertheless, in the opinion of the older and more experienced of district officials, I think it has been perceived that the existence of a trained sanitary staff is not devoid of utility, when such practical work as dealing with plague and cholera epidemics is forthcoming.

Both district boards and municipalities continue to adopt more or less careful measures in connection with large fairs and festivals. The preventing of the spread of epidemics from such centres has been long regarded as necessary in this Presidency. Indeed, the subject of fairs and festivals, was one of the first treated by the Sanitary Commission in 1863. Certain festivals, such as those at Conjeeveram, Tiruvannamalai and Tirupati were recognised as the starting point of the diffusion of cholera throughout the Presidency. But though, as already exemplified by the remark above quoted, in certain areas lack of supervision is still possible, the general tendency has been to improvement of sanitary arrangements at these important gatherings, with the result of their no longer being dreaded as foci for epidemics. For example, the occurrence of 645 attacks from cholera alone at the festival at Conjeeveram in 1831 which, judging from a record in my possession, seems to have been no extraordinary occurrence, would hardly have been regarded with equanimity in 1902. Cholera seventy years back was no more virulent a disease than it is at this date—the difference is due solely to the advance of sanitation in the interval.

ABSTRACT OF THE REPORT OF THE SANITARY COMMISSIONER FOR BOMBAY FOR 1902.

(*Lieutenant-Colonel J. W. Clarkson, I.M.S.*)

General Population.

European and Eurasian Vital Statistics.

The European Census population of 1901 in the Bombay Presidency exclusive of Cantonments in quasi-foreign territory, is 18,804. During the year 1902, 251 births and 302 deaths were recorded against 217 and 251 in 1901. A birth-rate of 13·35 per 1,000 against 11·54 in 1901 and a death-rate of 16·06 against 13·35. By sexes 133 males and 118 females were born against 120 and 97 in 1901, and as regards deaths 189 males and 113 females died against 162 and 89 in 1901.

The Eurasian Census population of 1901 is 6,557. During the year 1902 the births registered were 140 against 133 in 1901 and deaths 154 against 180, the rates being 21·35 per 1,000 against 22·84 in 1901 and 23·49 against 27·54. Of those born, 68 were males and 72 females against 66 and 67 in 1901; as regards deaths, 84 males and 70 females died against 95 and 85 in 1901.

Native Population—Vital Statistics.

Births.—In the Presidency of Bombay, including Sind, during the year 1902, there were 631,393 births registered against 465,647 in 1901. The recorded births for the year under report were thus 165,746 in excess of the number registered in the previous year, and also in excess by 10,384 over the decennial mean ending 1901. In eleven districts only, Khándesh. Násik, Thána, Kolába, Ahmednagar, Poona, Ratnágiri, Bijápur, Panch Maháls, Sukkur and Upper Sind Frontier, did the number of births exceed the deaths. The recorded birth-rate for the year was 34·16 per 1,000 against 25·19 in 1901 and a decennial mean of 33·06. The number of births recorded during the year was higher than in 1901 in all the collectorates except Kánara and the district of Upper Sind Frontier. The general birth-rate rose during the year owing to the diminishing effect of famine. In Kánara, especially in the forest area, the birth-rate continued low owing to malarious causes. In the Upper Sind Frontier the low birth-rate is due to defective registration.

There were 327,549 male and 303,844 female births recorded during the year against 242,382 and 223,265 in 1901. For every 100 female births 107·80 male births were recorded during the year.

The following statement shows the number of births recorded in each year since 1892:—

Year.	Number of Births.	Year.	Number of Births.	Year.	Number of Births.
1892	650,667	1896	691,847	1900	505,662
1893	664,305	1897	629,693	1901	465,647
1894	660,268	1898	582,371	1902	631,393
1895	674,304	1899	685,348		

The greatest number (58,310) was registered in the month of October and the least (43,115) in February. The highest and lowest registrations in 1901 occurred in the months of October and March. Whilst for the decennial 1892-1901 the maximum number of births also occurred in October and the lowest number in February. The rise in the birth-rate from the low rates obtained in the famine years of 1900 and 1901 was marked.

The recorded birth-rates among the urban and rural populations of the Presidency were 27·09 and 35·23 against 22·72 and 25·57 in 1901. Except in the collectorates of Dhárwár, Kánara, Kaira, and throughout Sind, the birth-rates were higher among the rural than the urban population. The difference is very marked in the Poona and Násik collectorates where the rural birth-rates are 40·93 and 45·18 against 14·83 and 22·80 among the urban. The chief cause of the difference in the urban and rural birth-rates is due to defective registration. Plague was a contributory cause. Correct results can never be obtained without compulsory registration. In Sind registration is apparently very defective. In the Upper Sind Frontier District the birth-rates among the rural and urban population were nearly the same, viz., 21·41 and 21·44 respectively.

Out of 56 towns and 7 cantonments in the Presidency, 7 had a birth-rate exceeding 40 per 1,000. Poona, Alibág, Karád, and Kalyán Towns and Ahmedabad, Deoláli, Kirkee, and Ahmednagar cantonments have very low birth-rates. It is notorious many towns do not register their births correctly and until Municipal By-laws are strictly enforced efficiency will not be obtained.

Deaths.—Among the Native population in the rural, town and cantonment circles in the Presidency 721,462 deaths were registered during the year 1902. In 1901, 686,134 deaths or 35,328 less than in 1902 were recorded. Of the total deaths registered, 369,491 occurred among males and 351,971 among females against 357,586 and 328,548 respectively in 1901.

The following statement shows the number of deaths recorded in each year since 1892 :—

Year.	Number of Deaths.	Year.	Number of Deaths.	Year.	Number of Deaths.
1892	611,742	1896	596,472	1900	1,318,783
1893	511,831	1897	749,916	1901	686,134
1894	607,179	1898	548,825	1902	721,462
1895	538,540	1899	672,269		

The death-rate per 1,000 in 1902 was 39·04 against 37·12 in 1901 and a decennial mean of 36·42.

The millesimal rate of males dying to males living was 38·77 and of females dying to females living was 39·32. In 1901 these ratios were respectively 37·52 and 36·70. For every 100 females who died, 104·98 deaths among males were recorded, but these proportions vary considerably as in Bombay City the ratio of males to females death was 134·82, in Karáchi collectorate 122·90 and Násik 108·70.

In the Western, Central, Southern, Gujarát and Sind Registration Districts the number of deaths recorded in 1902 were 188,727, 170,508, 151,785, 133,831, and 76,611 and their ratios per 1,000 42·71, 35·08, 46·07, 49·54 and 23·90 respectively. The highest death-rate occurred in the Gujarát Registration District, fever causing 26·28 of deaths and plague 6·54. The next highest rate took place in the Southern Registration District which suffered to a considerable extent from plague (18·87).

In the year 1902 the recorded death-rates per 1,000 of population, which ranged from 63·13 in the City of Bombay to 17·66 in the Upper Sind Frontier, were higher than in 1901 in all the collectorates except Thána, City of Bombay, Kolába, Ratnágiri, Belgaum, Dhárwár, Bijápur, Kánara, Broach, Ahmedabad and the district of Thar and Párkar.

Comparing the birth and death-rates in each collectorate for 1902, calculated on the census of 1901, the birth-rate in the City of Bombay was much below the registered death-rate 22·85 and 63·13 respectively; this may be ascribed partly to plague. In the

following collectorates the recorded birth-rates are lower than the registered death-rates :— Sholápur, Sátára, Belgaum, Dhárwár, Kánara, Surat, Broach, Kaira, Ahmedabad, Karáchi, Hyderabad, Lárkána, and Thar and Párkar.

As regards deaths by ages, the figures show per 1,000 living that the largest number of deaths took place in the period " under one year " and the next in the age period " 60 and upwards," the lowest ratio being in the period " 5 years and under 10."

The number of male births during the year was 327,549, while the male deaths under one year were 66,115 or 201·85 per 1,000. Among females the numbers were 303,844 and 57,842 respectively, the ratio being 190·36 per 1,000.

The " mortality of infants " as shown by the calculation asked for in Government Resolution, General Department, No. 5192, dated 7th September 1901, is very important, but the data are too inaccurate for correct deductions to be made and are misleading, *e.g.*, Bombay City returns an infant mortality of 565·93 male and 523·93 female infants per 1,000 registered births ; Ahmedabad 317·71 and 314·98 per 1,000 ; the whole Presidency 201·85 and 190·86.

Deaths by causes.—The subjoined table shows the deaths in 1902 arranged according to causes and contrasted with the results for 1901 and with the mean of the preceding five years. The " causes of deaths " will be briefly noticed in the next section :—

Causes of deaths.	Mean for 5 years, 1897–1901.		1901.		1902.	
	Number.	Ratio per 1,000 of population.	Number.	Ratio per 1,000 of population.	Number.	Ratio per 1,000 of population.
Cholera	49,509	2·64	13,600	0·74	3,229	0·17
Small-pox	4,568	0·24	5,340	0·29	2,189	0·12
Plague	78,237	4·17	128,259	6·94	184,752	10·00
Fevers	337,137	17·98	291,951	15·80	270,845	14·66
Dysentery and diarrhœa ...	99,186	5·29	60,198	3·26	58,682	3·17
Respiratory diseases	—	—	—	—	59,379	3·21
Injuries	7,262	0·39	7,092	0·38	7,434	0·40
Other causes	219,286	11·69	179,694	9·72	134,952	7·30
All causes	795,185	42·40	686,134	37·12	721,462	39·04

The greatest number of deaths (85,005) took place in December and the least (34,462) in June. In 1901 the greatest and least numbers occurred in October (73,187) and June (37,335).

The recorded death-rates among the urban and rural population of the Presidency were respectively 60·22 and 35·85 per 1,000 of population against 57·85 and 34·01 in 1901. Among the rural population the death-rate was higher than in the urban population in the collectorates of Dhárwár, Kánara and Broach.

Chief Diseases.

Cholera.—In the year 1902, there were 3,229 deaths recorded as due to cholera compared with 13,600 in 1901. The disease was somewhat severe in the collectorates of Karáchi and Hyderabad, where 1,981 or 4·47 and 1,078 or 1·09 deaths per 1,000 of population took place, respectively. Bombay City gave a few deaths every month, but the total for the year amounted to only 75. The collectorates of Sholápur, Sátára, Ratnágiri, Dhárwár, Bijápur, Panch Maháls and Lárkhána were entirely free ; practically also Násik, Kolába, Ahmednagar, Belgaum, Surat and Upper Sind Frontier, as only 1 death was reported from each of these collectorates. Thána and Broach gave 3 each. Ahmedabad 5, Poona 6, Kaira and Thar and Párkar 10 each, Sukkur 11, Khándesh 15 and Kánara 26.

In December 1901, the only area affected by cholera was the City of Bombay, but in January of the year under report, the collectorates of Belgaum and Kánara were affected in addition and 31 deaths were reported in the month. In the months of February, March and April there were 28, 20 and 22 deaths, respectively reported, but in May the mortality rose to 141 deaths out of which 132 were registered in the collectorate of Karáchi. In the month of June the collectorate of Hyderabad was affected and the mortality increased to 791 deaths in this month and reached its maximun in July, in which month 1,676 deaths were recorded. The number of deaths then suddenly fell to 379 in August and continued falling to the end of the year, there being 121 deaths in September, 13 in October and 2 in November. In the month of December 5 deaths were recorded, 4 in the City of Bombay and one in the collectorate of Ahmednagar.

In the year under report, the greatest number of deaths 2,967 occurred in the rainy season of 122 days against 3,371 during the same period in 1901. Whilst in 1901 the greatest number of deaths 5,319 took place in the cold season of 121 days, during the year under report only 84. 163 deaths were recorded in the hot and dry season of 61 days against 4,682 in the same season last year. In the hot and damp season of 61 days (October and November) 15 deaths were recorded against 228 during the same season of 1901.

The following table shows the total number of deaths from cholera in each of the twenty years ending 1901 :—

Year.	Number of deaths.	Year.	Number of deaths.	Year.	Number of deaths.
1883	37,954	1890	3,259	1897	57,109
1884	13,804	1891	17,850	1898	4,368
1885	37,287	1892	42,900	1899	8,579
1886	167	1893	18,853	1900	163,889
1887	25,711	1894	33,588	1901	13,600
1888	36,500	1895	8,890	1902	3,229
1889	32,431	1896	35,404		

Eighteen collectorates were affected by cholera, but in 16 of these the death-rate per 1,000 was very trivial. Of the remaining two collectorates, Karáchi and Hyderabad, which were entirely free last year, recorded a death-rate of 4·47 and 1·09, respectively. The average death-rate per 1,000 for the whole Presidency was this year 0·17 against 0·74 in 1901.

Out of 56 town circles in the Presidency 8 were affected by cholera during the year against 18 in 1901. The largest number of deaths, 354, or 3·14 per 1,000, was recorded in the town of Karáchi. In Hyderabad 167, or 2·43 deaths per 1,000 of population, took place. The City of Bombay recorded 75 deaths, against 197 during the previous year. Six deaths occurred in the City of Poona, while in the remaining four towns—Ahmednagar, Bulsár (Surat District), Ahmedabad, and Jacobabad—there was only one death recorded in each.

The affected area included 378, or 1·46 per cent., out of 25,846 villages in the Presidency, against 916 in 1901. The highest percentage took place in the collectorate of Karáchi, in which 228, or 36·08 per cent., of villages were affected. In the collectorate of Hyderabad there were 128, or 9·07 per cent., of villages affected, and in the remaining collectorates the number of villages affected were below one per cent.

Small-pox.—There were 2,189 deaths from small-pox (1,132 males and 1,057 females), against 5,340 in 1901, and a decennial mean of 4,106. The mortality, although less than that of 1901, and also of the mean for ten years ending 1901, was higher than that of the years 1898 and 1899. The Gujarát Registration District, except Surat, was free from the disease. The Southern Registration District recorded the highest mortality —979 ; next in order comes Western with 700, Sind with 362, Central with 115, and Surat, in the Gujarát Registration District, with 33. In the year under report 25·58 per

cent. of deaths occurred amongst infants under 1 year of age, whilst 39·30 per cent. took place among children 1 to 10 years, the remaining 35·12 being among persons over 10 years of age.

Fever.—There were 270,845 deaths registered under the heading "Fever" (139,817 males and 131,028 females), against 291,951 in 1901; thus there was a decrease of 21,106 deaths compared with the previous year. The decennial mean is 410,625, which includes the deaths from plague for the past six years. The death-rate was 14·66 per 1,000, as compared with 15·80 for the previous year and a decennial mean of 21·86, and this includes the deaths from plague during the years from 1896 to 1901. Like the year previous, the Gujarát Registration District recorded a high death-rate, but much lower than that of 1901. The mortality for the district was 70,978; next comes Sind with 59,811, Western with 56,684, Central with 51,302, and Southern with 32,070. In the collectorates of Ahmedabad, Broach, Lárkána, Kaira, Panch Maháls and Thar and Párkar high ratios are observed; this result is due apparently to famine causes to a certain extent. The number of deaths during the first six months of the year was lower than in the corresponding months of the previous year. The lowest mortality, 15,109, was reported in June, and it gradually rose, month by month, till November, when the highest mortality, 32,012, was recorded, and declined in December, when 29,166 deaths were recorded.

Plague.—During the year under report 184,752 deaths were recorded from plague—an increase of 56,493 deaths as compared with the previous year.

The number of deaths ascribed to plague in each year since 1896 is as follows:—

Year.	Number of deaths from Plague.	Year.	Number of deaths from Plague.	Year.	Number of deaths from Plague.
1896	2,086	1899	96,596	1901	128,259
1897	46,944	1900	33,196	1902	184,752
1898	86,191				

The mortality from this disease during the year was the highest recorded since its first appearance in 1896. All the collectorates in the Presidency except Upper Sind Frontier were affected.

The collectorates most affected were those of Sátára, Dhárwár, Belgaum, Khándesh, City of Bombay, Násik, and Kaira, with a death-rate of 29·37, 29·38, 27·42, 17·58, 18·13, 11·90, and 11·71 per 1,000 of population respectively. In the other collectorates the death-rate from this cause varied from 8·89 in Poona, 8·36 in Sholápur, 7·87 in Panch Maháls to 1·05 in Ahmedabad, 0·36 in Ratnágiri, and 0·01 in Lárkána and Sukkur. The collectorate of Panch Maháls, in which one death was reported during the previous year, returned 2,055 deaths, followed by Ahmednagar with 1,083, against 20 deaths during 1901. The rates per 1,000 for the various Registration Districts were as follows:—Western 11·59, Central 10·28, Southern 18·87, Gujarát 6·54, and Sind 1·16.

In January there were 16,753 deaths reported, and during March the number rose to 18,089. In April there was a substantial fall, which continued till June, when the minimum (1,539) was reached. In July the mortality again rose, and continued to increase, except a slight fall in November, till December, when the maximum number (30,507) was registered.

There were 2,694 towns and villages, or 10·38 per cent., affected by the epidemic, against 1,582, or 6·10 per cent., during the previous year.

Dysentery and diarrhœa.—Dysentery and diarrhœa caused the deaths of 31,333 males and 27,349 females, or a total of 58,682 persons, against 60,198 in 1901 and a decennial mean of 67,036, a decrease of 1,516 against last year, and 8,354 less than the decennial mean.

The deaths ascribed to "dysentery and diarrhœa" during the six years preceding 1897 showed only slight variations, but have, since 1897, shown a great increase. In the famine year of 1897 there was a sudden increase, which is but natural in a year of scarcity,

and was repeated to an even greater extent in the year 1900 ; but in the following year there was a decrease, and in the year under report these deaths fell below the deaths recorded in the previous year and also the decennial mean.

The Western Registration District records the ratio of 5·15 per 1,000 of population, against 4·50 in 1901 and 4·93 the decennial mean. The Central Registration District comes next with a ratio of 4·68, the Southern Registration District 2·57, the Gujarát Registration District 1·44, and the Sind Registration District 0·26. In the Presidency the rate was 3·17, against 3·26 in the previous year and a decennial mean of 3·56. All the collectorates, excepting Khándesh and Sholapur, show lower ratios ; the highest ratio (8·12) was recorded in the collectorate of Khándesh, followed by Sholápur, Násik, Poona, Ahmednagar, Bombay, and Belgaum. The recorded death-rates were 6·37, 5·99, 5·91, 5·45, 4·74, and 3·98 respectively, while in Sátára, Ratnágiri, Bijápur, and Kolába they were between 2 and 4 per 1,000 of population.

In each of the months from January to July the deaths ascribed to these causes were lower than those of the previous year, and were also lower than the decennial mean in the months from February to September, the month of May excepted ; but in the months of October, November, and December the deaths were higher than those of the previous year and also of the decennial mean.

Injuries.—During 1902, 4,107 males and 3,327 females, or a total of 7,434 persons, met with violent deaths. The mortality from these causes is higher by 342 than that reported in 1901, and also higher than the decennial mean of 6,629. Of the 7,434 deaths, 3,242 occurred from drowning, 1,288 from snake bites, 858 from wounding, 214 from hanging, 152 from attacks by wild beasts, 128 from poisoning, and 1,552 from other causes.

Other causes.—The recorded deaths from causes other than those specified number 134,952, or 18·71 per cent. of the total deaths, of which 67,052 occurred among males and 67,900 among females. The number of deaths under report do not include the deaths (59,379) from respiratory diseases as was the case last year.

The highest number of deaths (17,548) was recorded in the city of Bombay, followed by Dhárwár and Belgaum with 14,670 and 12,524 respectively, and the lowest (158 and 136) in each of the districts of Thar and Párkar and the Upper Sind Frontier.

Under this heading all deaths are included which cannot be classed under cholera, small-pox, fever, dysentery and diarrhœa, injuries, and respiratory diseases. The information obtained under this heading is of little scientific value, as the causes of death are not differentiated by the local Registrars.

Respiratory diseases.—The deaths recorded from respiratory diseases number 59,379, of which 30,743 occurred among males and 28,636 among females. The highest number of deaths (7,745) was recorded in the Kaira District, followed by Surat and Khándesh with 6,403 and 4,416 respectively, and the lowest (21, 5, and 3) in each of the districts of Lárkána, Upper Sind Frontier, and the Thar and Párker.

Sanitary Works.

During the year ending 31st March, 1902, there were 165 Municipalities in the mofussil, with a population, according to the census of 1901, of 2,349,729 souls. The total income of these Municipalities amounted to £414,910. Out of this sum £94,760 was expended on improving water-supply, drainage, and conservancy within municipal limits.

There are 23 District Local Boards, with 207 Táluka Local Boards. The entire income of these Boards during the year ending 31st March, 1902, amounted to £295,920, and out of this sum £10,740 was expended on water-supply and drainage.

The Bombay Village Sanitation Act of 1889 has been introduced into 294 villages, there being an increase of only two in the number this year. It would appear that owing to famine and plague, which claim the attention of the district officers, no progress has been made.

The number of selected villages in which the Village Sanitary Inspection Book has been introduced stands at 3,321 ; of this in about 1,518 villages the book has been written up by the officers of the Sanitary Department.

General Remarks.

The famine in Gujarát and the Deccan continued, and at one period of the year there was great apprehension that not only would the food scarcity continue but that in Gujarát a water famine would ensue. The rains which had held off till late in August then came down just in time, and timely falls in November and December were so beneficial that at the close of the year famine relief operations were practically closed.

During the year 1902 there were 24,185 in and 87,025 out-patients treated in 92 famine relief camp and poor-house hospitals and 2,341 deaths. The maximum number of admissions (4,702) was in the month of August. The maximum number of deaths (329) in the month of March. The minimum number of admissions and deaths was of course in December, when only three poor-house hospitals were open.

The greatest number of deaths (1,860) occurred in Ahmedabad District, out of which 669 occurred in the Dhuliakote poor-house, which contained all through a large number of very feeble and emaciated inmates. 216 deaths occurred in the Panch Maháls, 112 in Bijápur, 61 in Kaira, 60 in Sholápur, 28 in Ahmednagar, and 4 in Belgaum.

The chief mortality was due to dysentery and diarrhœa (1,049) ; 57 deaths were due to emaciation—of these 14 occurred in the Dhuliakote poor-house ; 403 were due to fever ; only 2 deaths were due to plague ; and 830 to other causes. There were no deaths either from cholera or small-pox.

There were in all 21 deaths due to starvation ; of these 11 were reported from the Dhuliakote poor-house, 1 from Wáda Taláo relief camp in the Panch Maháls, and one from Sidatpur relief camp in the collectorate of Ahmedabad ; 3 occurred in the town of Godhra, 2 in the city of Ahmedabad, 1 in Broach town, and 1 each in the collectorates of Surat and Dhárwár.

Real sanitary progress has been at a standstill for some years past. One of the chief obstacles to progress, though by no means the only one, is stated to be the want of funds. Sanitary schemes for water-supply are drawn up with much care and trouble only in the end to be shelved, because the financial part is uncertain, as witness the schemes for Dhárwár and Belgaum. If Government desire progress in this direction, aid must be afforded not only by way of loan, but by giving a direct money contribution of part of the cost. It is a matter of regret that out of the 5½ lákhs specially granted by the Government of India in the year 1902, some part could not have been devoted to helping Municipalities in large sanitary works, and I trust the Government of India will be pleased to allow this in future grants.

Municipalities consider themselves so badly off that it is with difficulty they will entertain project for even a water-supply, and although it is a quite sound sanitary proposition that water-supply and sewerage should go hand in hand, if this happy combination is waited for no progress will be made at all. In large towns nearly all sanitary progress depends upon adequate water-supply, and this should be supplied wherever possible, even at the risk of an increase of fever, but no house connections till sewerage is provided for. As regards sewerage, my experience, though many say that it is not suitable for Indian towns, is that nothing but sewers on the latest English methods will adequately remove the night-soil, urine and dirty water from a large Indian town, to outside where, however it may be disposed of, it will cause less harm than if left (as a large part of it is sure to be when removal is done by hand labour) to be absorbed within the inhabited area.

ABSTRACT OF THE REPORT OF THE HEALTH OFFICER OF THE PORT OF BOMBAY FOR THE YEAR ENDING 31ST DECEMBER, 1902.

Summary.—The following table shows that 15,432 vessels of all sorts with 701,964 crew and passengers were examined during the year ended 31st December, 1902, against 34,637 vessels with 886,310 crew and passengers who were inspected during the year preceding. The reduction in the numbers during the year under report was on account of the exemption from medical inspection of a large number of native sailing craft, Shepherd's Ferry steamers and other vessels which plied between the Port of Bombay and the ports on the mainland, bounded on the north by the Thána Creek and on the south by Nagothna and Roha, as per Government Notifications No. 1697-P. of 17th April, 1901, and No. 3,963-P. of 30th September, 1901.

The clothing and bedding of 93,479 crew and passengers of outgoing and incoming vessels were disinfected. Of this number 79,338 were native crew and third class or deck passengers who left the Port of Bombay for ports out of India; 8,359 were crew, prisoners-of-war, and British troops who arrived by transports from Durban; 1,260 were passengers from East African ports among whom cases of jigger were detected; 3,570 were pilgrims who returned from Mecca via Aden and other routes; and 952 were passengers who arrived by other infected vessels. The table further shows that 40 vessels on which cases of infectious diseases occurred were disinfected, and that 252 persons among whom cases of small-pox occurred were vaccinated. It also shows that at the outward and inward inspections and on board vessels lying in the harbour and docks, 44 cases of plague, 2 cases of cholera, 11 cases of small-pox, 106 cases of measles, 67 cases of chicken-pox, 30 cases of jigger, 3 cases of enteric fever and 1 case of scarlatina were detected. Chicken-pox is not one of the diseases declared by the Government of India as infectious under the Indian Ports Act, but commanders of vessels do not, as a rule, undertake the risk of conveying persons suffering from it to other ports where it may be considered as an infectious disease.

Statement showing the summary of the Shipping of the Bombay Port and the work in connection therewith for the year ending 31st December, 1902 :—

Vessels, including Country Craft.	Total Number of Vessels.	Number of Vessels inspected.	Number of Persons inspected, including crew on vessels.	Number of Native Crew and 3rd Class or deck passengers disinfected during the year.	Number of Vessels disinfected.	Number of Persons vaccinated.	Number of Persons segregated or rejected.*	Diseases and Number of Cases of each.								
								Plague.	Cholera.	Small-pox.	Measles.	Chicken-pox.	Jigger.	Leprosy.	Enteric Fever.	Scarlatina.
Entered	*35,506	98	25,273	14,141	40	252	71	1	—	4	101	5	30	—	3	—
Left	*33,110	15,313	676,691	79,338	—	—	3,289	28	—	7	1	51	—	—	—	—
In harbour during the year	*1,175	21	—	—	21	—	—	15	2	—	4	5	—	—	—	1
Total for 1902 ..	69,791	15,432	701,964	93,479	61	252	3,360	44	2	11	106	67	30	—	3	1
Total for 1901 ..	88,306	34,637	886,310	78,814	83	868	7,224	73	5	34	159	67	46	3	4	1

* These figures are supplied by the Customs Department and the Port Officer, Bombay.

Incoming Vessels.—In accordance with the rules in force medical inspection and disinfection were imposed on vessels which were actually infected, or suspected to be infected, with plague, cholera, small-pox, measles, scarlatina, black leprosy or other infectious disease on or before arrival at Bombay. Inspection for jigger was compulsory in the case of all vessels from East African ports. 98 vessels of various kinds with crews

of 8,154 persons and 17,119 passengers were inspected on arrival here. Six of these vessels were hired transports which arrived from Durban with 8,359 Boer prisoners and military details. Among the prisoners, 94 cases of measles and 3 cases of enteric fever were detected. The disinfection of the transports and of the clothing and bedding belonging to the crews, prisoners and troops was carried out under the supervision of the Port Health Officer. 59 vessels arrived from jigger-infested ports. They landed 118 cases at intermediate ports, and on arrival here had 30 cases of ulcers due to jigger and 1 case of small-pox. The patients were removed to the Goculdas Tejpal Hospital for treatment. These jigger-infested vessels as well as the clothing and bedding of their passengers, who numbered 1,260 in all, were disinfected. 21 vessels with 3,570 pilgrims arrived from Jeddah and had one case of small-pox. The clothing and bedding of the pilgrims were disinfected before they were made over to the Protector of Pilgrims for disposal. The remaining 5 vessels had on board 1 case of plague, 2 cases of small-pox, 7 cases of measles, and 5 cases of chicken-pox. The vessels and the kit of the persons among whom the cases occurred were disinfected.

His Majesty's ship "Pomone" arrived here with several cases of beri-beri, of whom 12 of the worst were sent to St. George's Hospital. At the request of the Naval Authorities the Port Health Disinfection Barge was placed at their disposal for the disinfection of the linen and clothing and bedding belonging to the vessel and to all on board. The Health Officer has no power to deal with cases of beri-beri, as it is not one of the diseases declared by the Government of India to be infectious under the Indian Ports Act.

The orders regarding the medical inspection of vessels arriving with horses from Australia have been cancelled, *vide* Government Resolution No. 6632 of 30th September, 1902. Consequently no such ships were visited by the Port Health Staff after that date.

In accordance with Government Resolution No. 2969 of 28th May 1902 vessels arriving from East African Ports were inspected with a view to detect cases of sleeping sickness. Up to the present no case of that disease has been discovered here.

Outgoing Vessels.—In accordance with the Medical Inspection Rules, published under Government Notification No. 3892-P., dated the 14th June, 1899, and Rule I. issued under Government Notification No. 2671-P. of 30th September, 1902, the medical examination of the crew and passengers of all vessels and the disinfection of the clothing and bedding of the Asiatic and African members of the crew, who were not officers, engineers, doctors, or Japanese, and of the deck third and fourth class passengers, and Asiatic and African servants bound for ports out of India were carried out immediately before they left the port of Bombay. The inspection of the crew and passengers was done by day, on shore, in sheds specially arranged for that purpose. The disinfection was carried out at the Disinfection Shed which is situated on the Frere Road, near the Prince's Dock.

During the year under report, 15,313 outward bound vessels with 239,040 crew and 437,651 passengers were inspected. At the inspection 3,289 persons were rejected. Twenty-eight cases of plague, 7 cases of small-pox, 1 case of measles, and 51 cases of chicken-pox were detected at the time of inspection.

Of the 15,313 outgoing vessels, 345 vessels with a crew of 34,067 persons and 32,177 passengers left far Aden or ports in the Red Sea and Europe ; 608 vessels with 38,596 crew and 42,607 passengers for other ports out of India, and the remaining 14,360 vessels with 166,377 crew and 362,867 passengers for Indian ports including Burma.

The clothing, bedding, boxes, and other suspected articles of 42,133 Asiatic and African members of the crew, and of 32,277 third and fourth class and deck passengers who sailed on steamers bound for ports out of India were disinfected at the place mentioned in paragraph 7 of this report. In addition to this disinfection, the kits of 4,155 crew and 773 passengers who sailed in native craft were also disinfected. Thus the total number of outward bound crew and passengers whose clothing, bedding, &c., were disinfected comes to 79,338 during the year under report, against 70,914 during the year preceding.

The Disinfection Shed was fitted with another Equifex sterilizer so as to enable the staff to get through the disinfection of the kit of crew and passengers of several vessels sailing about the same hour. The fitting up of the extra stove saved some vessels some delay and inconvenience.

As the disinfection of clothing and bedding by sulphur fumes is not recognised by the Venice Sanitary Convention, and as it is not in accordance with the orders laid down in the Appendix to the Medical Inspection Rules framed under the Epidemic Diseases

Act, arrangements were made with the Military Authorities for carrying out the disinfection of the clothing and bedding of all Native details by the Port Health Department.

The crew and passengers of four steamships which called at this port merely to land or embark passengers, were exempt from inspection and disinfection of their clothing and bedding in accordance with the proviso to Rule I. of the Medical Inspection Regulations. Such of the crew and passengers as embarked at Bombay on the vessels were inspected, by day, on shore; the new Native crew and the third and fourth class and deck passengers had their effects disinfected.

Infectious Diseases on Vessels in the Harbour.—Between 1st January and 30th June, 1902, 10 steamers and 11 Native sailing craft, which were lying in the docks and at the different bandars in the harbour, had on board 10 cases of plague, of whom 8 died; 2 cases of cholera, both of which proved fatal; 4 cases of measles; 5 cases of chicken-pox; and 1 case of scarlatina. In addition to these cases, 5 labourers were found dead in the Prince's and Victoria Docks and at Modi Bandar (Shepherd's Wharf). The deaths were reported to have occurred from plague. The disinfection of all these vessels and those referred to above under incoming vessels, as well as of the places where the dead bodies were found, was thoroughly carried out in accordance with the regulations. There was no case of plague or other infectious disease on vessels which were at anchor in the harbour during the period extending from 1st July to 31st December, 1902.

TABLE GIVING DETAILS OF INFECTIOUS DISEASES ON VESSELS WHILE LYING IN THE PORT OF BOMBAY DURING THE YEAR 1902 :—

Months.	Number of Persons who were attacked with Plague at Bandars and in the Docks.		Total Number of infected Vessels.	Total Number of Cases of Infectious Diseases in the Bombay Harbour.													
				Cholera.		Small-pox.		Measles.		Chicken-pox.		Plague.		Scarlatina.			
	Cases.	Deaths.		Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.		
1902.																	
January ...	3	3	3	—	—	—	—	1	—	2	—	4	4	—	—		
February ...	1	1	7	—	—	—	—	1	—	2	—	5	5	—	—		
March ...	1	1	7	—	—	—	—	1	—	1	—	6	6	—	—		
April ...	—	—	1	—	—	—	—	1	—	—	—	—	—	—	—		
May	—	—	2	2	2	—	—	—	—	—	—	—	—	—	—		
June ...	—	—	1	—	—	—	—	—	—	—	—	—	—	1	—		
July ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
August ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
September ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
October ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
November ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
December ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
Total for 1902			21	2	2	—	—	4	—	5	—	15	14	1	—		
Total for 1901			38	5	5	4	—	3	—	12	—	19	14	—	—		

Port Observation Camp.—The present area of land occupied by this Camp is 12,555 square feet, the monthly rent for which amounts to Rs. 87-14-2. Among the passengers and crew who were sent to the Camp 28 developed plague, and were transferred to the various hospitals in the city for treatment. The sheds of the Camp in which the plague cases developed were thoroughly disinfected with perchloride of mercury and were kept unoccupied for some days. The thorough disinfection of all the sheds was carried out frequently with the standard solution of perchloride of mercury. One hospital assistant

and one ayah were employed to look after the patients in the Camp. One of the Medical Officers was detailed in turn every month to supervise the general working of the Camp.

Disinfection of Ships and Infected Cargo.—During the year 61 vessels of all sorts were disinfected under the personal supervision of the Health Officer of the Port or of his staff. In certain instances the disinfection barge was placed at the disposal of the Naval and Royal Indian Marine authorities to carry out the disinfection of linen, mattresses, clothing and bedding belonging to Naval ships and transports.

A man was reported to have been found dead of plague on some bags of cotton seeds at the North Jetty extension, Prince's Dock. Twenty-five of the bags of seeds which were supposed to have been in contact with the deceased were disinfected by saturated steam under pressure. The cotton seeds were not destroyed by the process of disinfection, 20 bags of bones on board a country craft infected by a case of plague were also disinfected.

The vessels on which cases of cholera occurred had the drinking water which was stored on board discharged into the sea. The water-tanks were thoroughly disinfected inside with potassium permanganate solution before they were refilled with a fresh supply of drinking water.

General Health of the Shipping.—During the year, 996 persons connected with the shipping were admitted into the various hospitals in the City. The Saint George's Hospital admitted 558 European patients, of whom 20 died, 495 were discharged, and 43 remained after 1st January 1903 under treatment. The Jamsetjee Jeejeebhoy Hospital admitted 171 Native patients, of whom 11 died, and the Goculdas Tejpal Hospital 267 Natives, of whom 18 died. The diseases for which the patients were admitted were small-pox, measles, continued enteric and remittent fevers, dysentery, beri-beri, syphilis, gonorrhœa, debility, rheumatism, bronchitis, diarrhœa, pneumonia, abscess, ulcers, etc.

Red Sea Pilgrim Traffic.—Bombay was opened as a port of departure for pilgrims in accordance with Government Notification, General Department, No. 6051, dated the 5th November 1902. On receipt of this Notification steps were at once taken to clear the ground at Pir Pao and erect camps there. The Public Works Department had the first camp for 300 open on the 1st December, 1902, and 285 pilgrims were taken into it on that date for segregation for 10 days and after their clothing and bedding had been disinfected at the disinfection Shed on the Frere Road, near the Prince's Dock. Subsequently more pilgrims were found waiting in Bombay and advantage was taken of the offer of one of Mr. Essaji Tajbhoy's hulks free of rent. 341 pilgrims were segregated on this hulk for 10 days from the 3rd December. The second camp at Pir Pao for 420 pilgrims was ready on the 10th December, but pilgrims for it were not brought before 17th December, on which date 333 souls were admitted into it. As more pilgrims offered, and as the time for segregation was very short, some 22 tents (each of which was capable of accommodating 20 fighting men or 25 followers on service) were at once borrowed from the Arsenal, and 262 pilgrims were admitted into some of these tents on 22nd December.

The sanitary arrangements were attended to by a staff of male and female sweepers, and the excreta was removed and emptied into the sea. None was allowed to soak into the ground as the camps may be used next year and there was also the risk of contaminating the drinking water in the wells. The camps and grounds were constantly swept during occupation, and the huts were limewashed by the Public Works Department after being vacated by each batch of pilgrims.

In addition to the above 1,221 pilgrims who were segregated for 10 days in Bombay, 83 pilgrims from the provincial camp at Peshawar were received on 15 December which made a grand total of 1,304 pilgrims who passed through the camps from 1st to 31st December 1902.

The following pilgrim ships left Bombay on the dates shown :—

S.S. *Shahanoor*	left with	709	pilgrims	on 15th December,	1902.
„ *Ahmadi*	„	577	„	31st „	
		1,286			

During segregation 2 pilgrims died of debility and old age.

The pilgrim ships which left Bombay for Jeddah had no cases of plague or any other infectious disease during the voyage.

Inland Pilgrim Traffic.—Twenty-one vessels brought to Bombay 3,570 pilgrims from Mecca via Aden and other routes. The baggage of these returning pilgrims was

disinfected in the Port Health Disinfection Stoves. Pilgrims whose homes were up-country or beyond the frontier were not allowed to enter the town, but were handed over to the Protector of Pilgrims so that they may be sent direct from the Disinfection Shed to their homes by rail.

Sanitary State of the Harbour and Foreshore.—The sanitary state of the foreshore and of the various bandars, basins and docks has been reported as fairly satisfactory.

Cholera, Small-pox and Plague in the City.—The public mortuary returns show that 75 deaths from cholera, 288 deaths from small-pox and 13,820 deaths from plague occurred in the City.

Each individual who left this port was subject to a rigorous and searching examination for the detection of any symptoms suspicious of plague. In addition to this examination the personal clothing and bedding of such crew and passengers as came under the disinfection rules were thoroughly disinfected. This strict examination and disinfection have become so well known that very few persons actually suffering from plague attempt to travel by sea, as they know they will not be allowed to sail and may be detained in the camp or hospital.

Due intimation of any cases of plague which were known to have developed among the crew and passengers who were prevented from sailing to ports out of India was sent to the Government in order that the information may be communicated by wire to the authorities at the next port for which the vessel was bound. When a plague case occurred among those who were rejected from vessels bound for Indian Ports the fact was made known by the Port Health Officer to the authorities at the next port where the vessel was to call. This procedure was adopted so that other ports may have full information of what had taken place and be in a position to protect themselves.

Forty-four cases of plague were detected at the outward and inward inspections and in vessels lying in the docks and harbour. This decrease in the number of cases detected is due to the fact that a great number of the rejected were turned into the town and were lost sight of, whereas in the years in which a large number of cases were detected, the persons who were rejected at the inspections were detained in the various camps which existed at the time until they showed clear signs of plague or until it was certain that the symptoms from which they suffered were not due to plague.

ABSTRACT OF THE REPORT OF THE CALCUTTA MUNICIPALITY FOR 1902-1903.

(*R. T. Greer, Esq., Chairman.*)

Suburban Drainage Works.—It is gratifying to note that the whole of the works comprising the Suburban Sewerage Scheme have received the sanction, both of the Corporation and of the Government of Bengal. They are being carried out under eleven separate contracts, eight of which have been executed, the works to which they relate being in progress. At the close of the year tenders were being invited for the remaining three contracts. The Engineer's report of the 31st December, 1901, which dealt with the sewerage of Alipore and Kidderpore Districts, with the addition of Main Sewer No. 1, and its branches, were adopted by the Corporation in April, 1902, and received the sanction of the Government in May, 1902. His report of the 1st July, 1902, which embraced the remainder of the scheme (the construction of sewers in the amalgamated area between Palmer's Bridge and Tolly's Nullah, in Wards 19, 20, 21 and 22) received the sanction of the Government in November, 1902. These latter works were remodelled and redesigned on the recommendation of Mr. Baldwin Latham and of a Committee of Engineers who scrutinised the proposals. The whole of the sewerage works are estimated to cost £446,000. It is expected that considerable progress will be effected during the coming year.

The Corporation have also approved the Engineer's Scheme for the drainage of Belliaghata, the estimated cost being £8,185. The measure, however, has not yet received the sanction of Government. A scheme for the drainage of the Fringe Area should be ready before the close of the current year. A surface drainage Scheme in connection with the Suburban drainage is under preparation.

The Water-supply.—The total quantity of filtered water supplied from the main works at Pulta during the year was 7,542,012,530 gallons, a slight increase upon the previous year, the average consumption per head of the population being reported as 24·23 gallons. During the year 2,304 feet of pipes were added to the system, bringing the total mileage of filtered water mains and services to 317·34 miles, of which 184 miles are within the town area.

Some progress has been made in carrying out the scheme for the conversion of the present intermittent supply into a continuous system, which was approved by the Corporation in May, 1902. The area reported to have been brought under constant supply and control of waste-water meters includes the western portion of Ward No. 1, the whole of Ward No. 2 and part of Ward No. 3, in the Tallah Pumping Station sphere, and parts of Wards 6 and 8 in the area served by the Halliday Street Pumping Station. The work done includes the fixing of 37 Deacon's waste-water meters and 5,356 stopcocks for house-connections, and the substitution of unfiltered for filtered water in 1,089 privies throughout the town. The wastage in the area under the control of waste-water meters has been greatly reduced, but it is still enormous in the remainder of the town. Special monthly reports are submitted on the progress of the work under the scheme, and are considered by a special Sub-Committee. It has been felt that better progress might be made by increasing the staff, and the Commissioners have accordingly sanctioned the appointment of an expert for three years on a salary of £50 per mensem. This officer will work independently of the present Assistant Engineer, and will be given charge of a separate area with an appropriate staff.

The new additional reservoir at Tallah is being constructed, and will be ready for use in a few months' time.

The total quantity of unfiltered water pumped through the mains during the year was 5,659,865,427 gallons, the average consumption per head of the population being

shown as 19·24 gallons. No less than 74,408 feet or 14·09 miles of unfiltered mains were laid down during the year, bringing the total mileage to 172·24 miles, of which 134·72 are in the town area. The expenditure on the extension of the unfiltered supply amounts to over £27,600, the pipes alone costing £20,230.

Bustees.—The work of the Bustee Department has been carried on mainly on the same lines as in the previous year. The work of the Special Plague Department in demolishing plague-infected huts operated towards the improvement or clearance of bustees. In many cases the owners, seeing the removal of obnoxious huts, used the opportunity to utilise the land for pucca dwelling-houses and thus brought about a permanent improvement in the locality. Two hundred and twenty-eight huts have been demolished during the year thereby removing some of the most insanitary plague spots in the city. The General Committee have finally approved the standard plans in the case of thirthy-one bustees whose insanitary condition had been specially reported. The Corporation have determined to acquire Goomghur Bustee and to open out Manick Bose's Ghât Bustee by making several new roads. It has been found that owners who have valuable lands in the town, when called on to make improvements in their bustees, prefer to build masonry structures on their lands. Two bustees, for whose improvement plans had been prepared, have been entirely cleared away, and three others have been partially demolished during the year. In several other cases the owners are erecting pucca buildings.

To prevent the repetition in the added area of the insanitary conditions existing in the bustees in the town, a special temporary staff of Surveyors has been employed to make alignments, as provided for in the Building Sections of the Act, for growing bustee areas in the suburbs. The system is still in an experimental stage, and any report as to its effectiveness would be premature although there is promise of good results. The standard plans provide for suitable roads and passages, lane and court-yard space, surface drains, and latrine and bathing accommodation. There appears to be no special cause for the condemnation of the bustee system of hut dwellings on sanitary grounds, provided that sufficient care is taken in these particulars and measures are enforced against overcrowding.

In any scheme for a general improvement of the health of the city the remodelling of bustees must occupy a foremost place. Overcrowding, want of air space, light and drains, and the absence of proper sanitary conveniences are the prominent faults in existing bustees, and these can be remedied only by wholesale measures. The provision of accommodation for the surplus population must accompany any properly devised scheme for the demolition of insanitary bustees. Public opinion appears to be unfavourable to the construction of blocks of model dwellings for the labouring classes out of the funds of the Corporation, and in view of many failures in this direction in European cities, the success of any experiment of the kind in Calcutta cannot be considered as a certainty. The Corporation are taking steps to provide such dwellings for their menial staff, and will thus afford a good object lesson to landed proprietors. The suburbs offer suitable opportunities for those whose occupations do not require them to reside in the interior of the city, and they form the bulk of the labouring classes. The creation of wide thoroughfares in the suburbs with municipal conveniences and cheap tram-cars, would encourage the movement of the immigrant population to these quarters, and tend to solve the difficulties arising from overcrowding in the interior. The Corporation are pursuing this policy in the south of the city, and at present have in hand schemes more or less advanced for the construction of 60 feet wide roads at a cost of about £140,000. The prospect of the so-called Calcutta Improvement Scheme has checked operations of this kind in the north of the city, but there is land available to the north of Tallah, where the city can readily extend, and the surplus population find ample space for settling down without seriously interfering with their present work. Remodelled bustees will meet the requirements of the remainder and possibly blocks of model dwellings will in time become more popular.

In dealing with the improvement of bustees the operations of the Corporation are now confined to requiring that the necessary roadways and drains are constructed, the prescribed space between huts opened out, and that the necessary Municipal conveniences are provided. An effort is being made to check the growth of insanitary bustees, where huts have been demolished, by prescribing alignments for roadways, and thus providing that new structures shall be free from many existing objections. On sanitary grounds the complete demolition of a bustee is often desirable, the huts being incapable of improvement. The Plague Department have thus satisfactorily dealt with a number of insanitary dwellings. An efficient scheme for the improvement of Calcutta must include provision for the surplus population who are disturbed by demolitions.

Plague.—The mortality from plague during 1902-3 was 8,955, the largest yet recorded in Calcutta since the plague first appeared in the city five years ago. This is due mainly to the severity of the present outbreak, which reached its maximum in the middle of March, when 894 deaths were reported for the week. On the other hand, the figures for the quiescent (inter-epidemic) period, namely, from July, 1902, to January, 1903, are the lowest recorded for the past three years. The onset of the present epidemic took place later than usual, but the mortality from plague increased with such rapidity that, by the end of January, all the former totals for that period of the year had been left behind.

There appears to be no doubt but that the type of plague has been more virulent during the present epidemic than in any of the previous ones, the high case mortality being the subject of remark amongst both patients and practitioners. The progress of the epidemic could be traced from the usual plague-centres in the city, namely, the dâl and grain godowns in Jorabagan, Ward V, and in Chitpore-Ahiritolla Bustees, Ward II, to the grain godowns in their neighbourhood, and later to the wards in the south-eastern districts of the city and to the added areas. As in previous years there has been a widespread epidemic amongst rats, which began in Ward II, reached its maximum in the beginning of January, and declined before the epidemic amongst human beings broke out. The fact tends to support the belief that rat mortality precedes the appearance of epidemic plague.

The chief remedial measures have been the disinfection of plague-infected rooms and huts and the demolition of the latter under the Plague Regulations where disinfection could not be efficiently carried out, adequate compensation being paid to the owners. The demolitions have been effected in most cases by the hut-owners themselves.

The attitude of the people has been more friendly than in former years. The poorer classes appear to have gained more confidence in the officers of the Plague Department, and they have rendered greater assistance in reporting plague deaths than heretofore. The amount of voluntary evacuation of plague-infected dwellings in Ward V, especially, has been striking, and disinfections have been frequently applied for.

There were only nine (9) applicants for inoculation with Haffkine's serum.

Health Department.—The Health Officer reports that the death-rate of the town during 1902-03 was 37 per 1,000, due in a large measure to the recurring epidemic of plague in the first half of the year. Excluding this factor, the figure is reduced to 28·4, which is only slightly above the mean of the decade, or 27·4 per 1,000. Cholera accounted for a larger number of deaths than usual, the disease being virulent during the year throughout the province generally. An important reform was introduced in June, 1902, under which all cases of death in the town are inquired into by the Sanitary Inspectors, who, with one exception, are qualified medical men. One result has been the detection of a considerable increase in the mortality from tuberculosis. The Health Officer is of opinion that this disease accounts for fully 10 per cent. of the total mortality, and statistics show that the number of deaths from phthisis and pulmonary disease has more than doubled in the last thirty years.

The birth-rate is low compared with the other Presidency towns, and this may be largely ascribed to defective registration. The Health Officer has recommended the adoption of a system which obtains in Madras, where a number of men on comparatively small pay are employed, each in a circumscribed area, to make local inquiries. The Corporation have decided to give the measure a trial for a year in one of the four Districts.

The work of vaccination has, during the past year, been entrusted to men of the Hospital Assistant class, who have replaced the unqualified men hitherto employed. The Health Officer does not consider that the change, so far, has been for the better, and he describes the vaccination work generally as unsatisfactory. A Special Committee of medical men has been appointed to deal with the subject, and it is proposed to consult the Inspector-General of Civil Hospitals and the Sanitary Commissioner of Bengal.

A new Vaccine Depôt is being constructed at Ballygunge, at a cost of £1,820 exclusive of the value of the land, the acquisition of which cost £590. The Corporation have, during the past year, manufactured their own lymph under considerable difficulties, the Government supply having ceased. It is expected that the new depôt will be ready before next cold weather. New Vaccination Stations and Registration Offices are also about to be constructed in Wellesley Street and Elliot Road.

Under the Reorganisation Scheme, the work of food inspection formed part of the duties of the Sanitary Inspectors. It was found, however, that these Officers could not

devote sufficient attention to their work, and the Corporation accordingly strengthened the Health Department by the appointment of five Food Inspectors, one for each of the four districts and a special officer for Sealdah Station, where large quantities of fish are brought daily by rail. These men occupy the same standing as Sanitary Inspectors. Large quantities of unwholesome food were destroyed during the year, and the Inspectors successfully prosecuted several prominent ghee merchants for selling adulterated articles. An important test case of adulterated mustard-oil was taken before the Magistrate, and the prosecution ended in a conviction. The appeal against the conviction has failed in the High Court.

Conservancy.—The Conservancy of the town is one of the first cares of the Corporation, who do not grudge the payment of any necessary expenditure under this head. The Gowkhana staff has been strengthened, and additional carts and animals have been provided. An improvement is noticeable in the condition of some of the streets, especially where men and boys are constantly engaged in collecting horse-droppings and refuse. Much yet remains to be done, particularly in the matter of providing an efficient afternoon service in the more thickly-populated areas of the native portion of the town where it would be almost impossible, at present, to enforce action under Section 430. When the two new Gowkhanas now under construction in Districts I and IV have been completed, each district will have its own supply and separate staff of animals and carts, and it will be possible to make more efficient provision for the better cleansing of the streets. The improved condition of the Gowkhana animals reflects credit upon those responsible for their care.

ABSTRACT OF THE REPORT OF THE HEALTH OFFICER OF CALCUTTA FOR 1902-1903.

(*Dr. J. Nield Cook.*)

Births.—The birth-rate of the town calculated on the registerd births was 14·2 per 1,000 of the population. In order to ascertain to what extent the low birth-rate was due to defeetive registration, I worked out the birth-rate per 1,000 females between the ages of 15 and 40 in the three Presidency towns, and found that in Calcutta it was 72·1, in Bombay 92·6, and in Madras 175·8. If the Census figures can be relied on and the fecundity of the women is approximately the same in the three towns, it follows that 1·28 births are registered in Bombay and 2·44 in Madras to every 1 registered in Calcutta. It further follows that if the registration in Calcutta were equal to the registration in Madras, the number of births registered would be 22,250, giving a ratio of 26·3 per 1,000 of the population, which is nearly double the rate on the births actually registered. In Madras a number of men on comparatively low pay are employed, each in a circumscribed area, to make inquiries of midwives, policemen, barbers, headmen of hutting grounds, old women and anyone else who is likely to be able to give information of births, and as this system appears to have produced an approximately accurate registration of births I recommend its adoption in Calcutta, and the Commissioners have sanctioned a trial of it for one year in one of the four Districts into which the town is now divided, with a view to its general adoption if it should prove successful. The number of still-births was 4·9 per cent. of the total births including the still-born.

Deaths.—The death-rate of the town was 37. A recurring epidemic of plague in the first half of the year was the cause of this high figure. If this disturbing factor be subtracted from the total deaths the ratio works out to 28·4, which is only slightly above the mean of the decade exclusive of plague, the slight excess being attributable to plague deaths falsely registered under other causes which always happens in an epidemic. Plague was administered by a special department independent of the Health Department, reliance being placed mainly on disinfection. The mortality was rather less than the previous two years, but judging by the course of the disease in the present year, 1903, up to the time of writing, there is no reason to believe that the disease shows signs of weakening. The most remarkable feature is the regularity of its rise and fall, year by year, according to season and locality. Cholera accounted for more deaths than usual. Most of the cases can be traced to the consumption of water from tanks and wells, which are still numerous in the town. It was a bad cholera year in the province generally. In the 24-Perganas which nearly surround Calcutta the cholera mortality was double that of the previous year; consequently many cases were imported and formed *foci* of disease. The deaths registered under "Fevers" were a good deal below the mean, though prevalent in the surrounding districts; the Malarial Commission visited Calcutta and reported that, though the Anopheles Rossii existed in myriads in the native houses, there was no malarial infection of the native children, nor sporozoits in the anopheles. The mortality from small-pox was comparatively low again after two rather bad years, though it was very prevalent in the Province of Bengal, this disease having approximately a five years' cycle in Calcutta. Enteric fever accounted for 81 deaths. This is considerably above the average, but I believe it to be below the actual number, as a number of cases that occur amongst natives are diagnosed as remittent fever. From the month of June all the cases of death that occurred in the town were inquired into and reported on by the Sanitary Inspectors who are nearly all qualified medical men. One result of this was to show a considerable increase in the mortality from tuberculosis, mostly pulmonary phthisis, which, from June to December inclusive, amounted to 6·4 per cent. of the total mortality. I am satisfied that this figure is much too low, and that this disease accounts for at least 10 per cent. of the total mortality of Calcutta. A large number of cases of

The following statement shows the mortality from the principal diseases in 1902 compared with the average of the previous five years.

1. No. of Wards.	2. Names of Wards.	3. Population according to Census of 1901.	4. Cholera.	5. Small-pox.	6. Fever.	7. Dysentery and Diarrhœa.	8. Plague.	9. Injury.						10. All other Causes.	11. Total Deaths from all Causes.	12. Ratio of Deaths per 1,000 of Population.							
								Suicide.														*From all Causes.*	
								Male.	Female.	Wounds and Accidents.	Snake-bite or by Wild Beasts.	Hanging-Execution.	Total.			Cholera.	Small-pox.	Fever.	Dysentery and Diarrhœa.	Plague.	Injury.	All other Causes.	For the Year.	Mean of previous Five Years.
1	Shampooker	46,887	213	3	379	191	376	—	1	10	—	—	11	650	1,823	4·5	·06	8·0	4·0	8·0	·23	13·8	38·8	30·2
2	Coomartolly	30,155	176	4	167	142	330	2	3	11	—	—	16	402	1,237	5·8	·13	5·5	4·7	10·9	·53	13·3	41·0	38·1
3	Burtollah	50,216	183	3	334	186	441	5	3	24	—	—	32	808	1,987	3·6	·05	6·6	3·7	8·7	·63	16·0	39·5	31·7
4	Sukea's Street..	42,034	137	5	293	147	371	1	4	13	1	—	19	611	1,583	3·2	·11	6·9	3·4	8·8	·45	14·5	37·6	29·6
5	Jorabagan	49,069	217	23	245	196	1,112	5	4	24	—	—	33	581	2,407	4·4	·46	4·9	3·9	22·6	·67	11·8	49·0	41·0
	Mayo N. Hospital	—	11	—	8	4	6	—	1	3	—	—	4	26	59	—	—	—	—	—	—	—	—	—
6	Jorasanko	52,988	187	16	266	220	614	4	2	23	—	—	29	855	2,187	3·5	·3	5·0	4·1	11·5	·54	16·1	41·2	34·1
7	Burra Bazar	31,574	110	8	128	64	516	5	—	7	—	—	12	252	1,090	3·4	·25	4·0	2·0	16·3	·38	7·9	34·5	32·3
8	Colootollah	63,170	174	12	387	199	870	6	3	23	—	—	32	866	2,540	2·7	·19	6·1	3·1	13·7	5	13·7	40·2	31·2
	Medical College Hospital ..	—	17	—	15	9	19	3	—	12	—	—	15	127	202	—	—	—	—	—	—	—	—	—
9	Moocheepara	64,116	152	6	412	149	470	7	4	14	—	—	25	987	2,201	2·3	·09	6·4	2·3	7·3	·38	15·3	34·3	29·9
	Lady Dufferin's Hospital ..	—	—	—	1	—	—	—	—	—	—	—	—	5	6	—	—	—	—	—	—	—	—	—
	Police Hospital	—	4	—	7	1	3	—	—	—	—	—	—	2	17	—	—	—	—	—	—	—	—	—
10	Bow Bazar	27,052	46	2	151	98	261	1	—	9	—	—	10	403	971	1·7	·07	5·5	3·6	9·6	·36	14·8	35·8	29·7
11	Puddopooker	28,060	83	2	138	90	185	5	2	9	—	—	16	430	944	2·9	·07	4·9	3·2	6·5	·57	15·3	33·6	26·5
12	Waterloo Street	6,395	22	—	28	11	34	—	—	5	—	—	5	37	137	3·4	—	4·3	1·7	5·3	·78	5·7	21·4	17·2
13	Fenwick Bazar	31,242	58	7	146	89	434	2	3	10	—	—	15	297	1,046	1·8	·22	4·6	2·8	13·8	·48	9·5	33·4	28·6
14	Taltollah	32,237	52	2	223	108	255	—	1	11	—	—	12	584	1,236	1·6	·06	6·9	3·3	7·9	·37	18·1	38·3	32·8
15	Collinga..	16,780	9	1	117	44	118	—	1	5	—	—	6	247	542	·53	·05	6·9	2·6	7·0	·35	14·7	32·3	27·6
16	Park Street..	6,127	4	—	18	3	18	—	—	1	—	—	1	37	81	·65	—	2·9	·48	2·9	·16	6·0	13·2	14·6
17	Bamun Bustee	5,503	—	—	12	4	3	—	—	3	—	—	3	56	78	—	—	2·1	·72	·54	·54	10·1	14·1	22·8
18	Hastings	4,444	8	1	88	17	28	—	—	—	—	—	—	65	207	1·8	·22	19·8	3·8	6·3	—	14·6	46·5	48·1
	Military Hospital	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total	588,049	1,863	95	3,563	1,972	6,464	46	32	217	1	—	296	8,328	22,581	3·1	·16	6·0	3·3	10·9	·5	14·1	38·3	32·0
	Fort William	4,612	3	—	34	1	—	—	—	—	—	—	—	29	67	·65	—	7·3	·21	—	—	6·2	14·5	12·7
	Port of Calcutta	20,768	66	—	40	9	—	1	—	20	—	—	21	5	147	2·2	—	1·5	·3	—	·7	·16	4·9	6·5
	Grand Total ..	622,429	1,932	95	3,643	1,982	6,464	47	32	237	1	—	317	8,362	22,795	3·1	·15	5·8	3·1	10·3	·5	13·4	36·6	30·7
19	Entally	38,626	135	5	354	135	292	5	3	16	—	—	24	600	1,545	3·4	·12	9·1	3·4	7·5	·62	15·5	39·9	41·0
	Campbell Hospital	—	38	4	124	418	17	—	—	7	—	—	7	377	985	—	—	—	—	—	—	—	—	—
20	Baniapooker	28,202	34	1	308	101	111	1	—	3	—	—	4	462	1,021	1·2	·03	10·9	3·5	3·9	·14	16·3	36·2	46·9
	Albert Victor's Leper Asylum.	—	—	—	—	—	—	—	—	—	—	—	—	12	12	—	—	—	—	—	—	—	—	—
21	Ballygunge and Tallygunge	27,207	77	—	312	106	57	—	1	10	1	—	12	479	1,043	2·8	—	11·4	3·8	2·0	·44	17·7	38·3	34·8
22	Bhowanipur	49,641	242	3	431	209	128	1	1	14	—	—	16	715	1,744	4·8	·06	8·6	4·2	2·5	·32	14·4	35·1	32·2
	General Hospital	—	7	—	1	6	—	—	—	1	—	—	1	18	33	—	—	—	—	—	—	—	—	—
	Shumbu Nath Hospital ..	—	1	—	1	13	—	—	—	6	—	—	6	59	80	—	—	—	—	—	—	—	—	—
	European Lunatic Asylum	—	—	—	—	1	—	—	—	—	—	—	—	4	5	—	—	—	—	—	—	—	—	—
	Alipur Lock Hospital ..	—	—	—	—	2	—	—	—	—	—	—	—	2	4	—	—	—	—	—	—	—	—	—
	Do. Jail Hospital ..	—	1	—	3	3	—	—	—	1	—	1	2	27	36	—	—	—	—	—	—	—	—	—
	Do. Police Hospital ..	—	—	—	2	3	—	—	—	—	—	—	—	6	11	—	—	—	—	—	—	—	—	—
	Do. Police Case Hospital	—	—	—	—	—	—	—	—	1	—	—	1	2	3	—	—	—	—	—	—	—	—	—
23	Alipur	17,718	69	12	96	66	21	—	1	7	—	—	8	178	450	3·8	·67	5·4	3·7	1·1	·45	10·0	25·3	23·5
24	Khidderpur and Ekbalpur	21,608	28	1	150	73	52	—	—	15	—	—	15	406	725	1·0	·03	5·6	2·7	1·9	·56	15·2	27·2	27·6
25	Watgunge and Garden Reach..	37,918	149	6	166	87	136	2	1	10	—	—	13	351	911	3·9	·15	4·3	2·2	3·5	·34	9·3	24·0	23·6
	Total	220,920	781	32	1,948	1,223	814	9	7	91	1	1	109	3,701	8,608	3·5	·14	8·8	5·5	3·6	·49	16·7	38·5	38·4
	Canal	4,447	3	—	2	1	—	—	—	1	—	—	1	—	7	·67	—	·44	·22	—	·22	—	1·5	4·0
	Grand Total ..	225,367	784	32	1,950	1,224	814	9	7	92	1	1	110	3,701	8,615	3·4	·14	8·6	5·4	3·6	·48	16·3	38·2	37·5
	Combined Total ..	847,796	2,716	127	5,593	3,206	7,278	56	39	329	2	1	427	12,063	31,410	3·2	·14	6·5	3·7	8·5	·5	14·2	37·0	82·5

malarial fever subsequently die of tuberculosis, but are registered under the former head, the pulmonary symptoms attracting but little attention. There is no doubt that a number of cases of abdominal tuberculosis are diagnosed as chronic dysentery, and it is a common practice in the town to call any disease in which dyspnœa is a prominent symptom of asthma, and an impossible number of deaths are registered under this head. The evidence of the hospitals supports my view of the prevalence of this disease, for out of 966 consecutive post-mortems at the Medical College Hospital, in 13·4 per cent. death was due to pulmonary tuberculosis, and in 3·6 per cent. to other forms of tubercular disease. Medical practitioners in the town tell me that the disease is on the increase amongst the well-to-do as well as amongst the poor, and our municipal records show that the mortality from phthisis and from pulmonary disease generally has more than doubled in the last thirty years. Tuberculosis of cattle is a rare disease here, and the Hindus generally do not eat beef. Moreover, it is the general practice amongst natives of this country to sterilise milk and its derivatives, such as ghee, curd, and *channa* before using them for food. This eliminates what is supposed by many to be a common cause of infection, and there is no doubt in my own mind that the disease is spread by direct infection from person to person living together in crowded and ill-ventilated rooms principally by the germ-laden spray of coughing and sneezing being directly inhaled, and to a less extent by dried sputum in dust. The fact that the phthisis mortality has doubled in Calcutta, whilst in England and Germany it has been reduced to about half, points above all to the necessity of adopting a comprehensive policy for the better housing of the poor. But as it will certainly be a long time before any considerable improvement can be effected in Calcutta in this respect, I have recommended the following special measures for dealing with the disease :—

(1.) Careful inquiries by the Sanitary Inspectors or special officers appointed for the purpose, compulsory notification being impracticable.

(2.) Periodical disinfection of affected houses.

(3.) The dissemination of general information by leaflets and in other ways, and instructions how to deal with a case at home and minimise the risks.

(4.) The establishment of a home for advanced cases.

Vaccination.—The total number of vaccinations done during the year was 17,534, which is less than half the number done in the previous year. The falling off occurred in all the four districts, as shown below :—

—	1901.	1902.
District I.	10,074	4,222
District II.	9,669	4,456
District III.	7,026	2,667
District IV.	8,777	6,189
Port	84	—
Total	35,630	17,534

It is evident from the above figures that the causes of the fall were general, affecting all the four Districts. Vaccination was done during the year by hospital assistants, working directly under the District health officers, the inspectors having been abolished. The years 1900 and 1901 were marked by the cyclical prevalence of small-pox, which has now subsided. During the years when the disease is epidemic special efforts are made to get people vaccinated, and they show greater readiness to avail themselves of vaccination. When it subsides there is generally a fall. But making all due allowance for this, I consider that the results are unsatisfactory. I believe that the following causes contributed :—

(*a.*) Both the District health officers and the vaccinators were new to the work.

(*b.*) There were constant changes in the department, the vaccinators throwing up their appointments to take others which were more remunerative or more congenial.

(*c.*) A vaccination department requires more supervision than the District health officers, who have many other duties to perform, can give it.

A new vaccination depôt was built during the year at No. 1, Shikdarpara Street, and the site has been purchased, plans passed, and tenders accepted for the construction of a depôt for animal vaccination and the manufacture of preserved vaccine in Ballygunge. As a temporary measure vaccine is being prepared in the bacteriological laboratory, the calves being kept in a shed in the yard. Some trouble has lately been experienced owing to an outbreak of rinderpest among the vaccinated calves, but that has now been got over and the lymph supply is of good quality. Recently some glycerised lymph has been made as well as lanolised, and it has been found here, as in England, that septic germs decrease rapidly in glycerised lymph, but increase with keeping when it is prepared with lanoline. When the new depôt is opened I propose to give up lanoline altogether in favour of glycerine.

Filtered water supply.—Two samples of filtered water from taps in the town were examined every week, both chemically and bacteriologically, and the results submitted to the General Committee, as required under Section 243 of Act III. (B. C.) of 1899. As in previous years the total solids, chlorine as dissolved chlorides and the total hardness ranged comparatively high from January to June, varying between 20 to 28, 0·7 to 3·7, and 9 to 15·5 parts per 100,000 respectively. The albuminoid ammonia, as determined by Wanklyn's process, and the nitrates varied, within narrow limits, from 0·004 to 0·006 and 0·019 to 0·029 respectively, the "oxygen consumed" ranging from 0·004 to 0·01. No nitrates were present in any of the samples. During the rains there was, as usual, a slight turbidity or opalesence. This can be thrown down by alum in the laboratory ; but as it does not apparently affect the quality of the water but only its appearance, it is not considered necessary to adopt a system of precipitation at the waterworks. About 50 to 60 bacteria to the cubic centimetre were generally found to be present in the town water. The only unsatisfactory feature of the water was the continued presence of bacteria of the Colon group, which were found in every examination of the filtered water in relatively large numbers. Their presence could almost invariably be detected in 0·5 c.c. of filtered water by the formation of gas and acid, and was in some instances detected in 0·2 c.c. In the river water, before settling and filtration, they could generally be detected in 0·1 c.c., and were detected in as small a quantity as 0·01 c.c. There is no evidence that their presence has proved injurious to persons drinking the water, but they cannot but be a cause for anxiety. I attribute their presence mainly to riparian villages, and recommended that measures should be taken for improving the conservancy of the river, but this was regarded as "a counsel of perfection." Bacterial enumerations were made every week from the outlet wells of the 36 filter beds at Pulta, to show whether the filter beds were working efficiently. Any filter that showed over 100 to the c.c. was at once cut off. No definite relation could be shown between the number of bacteria present and the head of water on the beds, or the number of days the filters had been in use. In addition to the above, examinations of 233 samples of water from the river, settling tanks, Tolly's Nullah, and tanks and wells in the town, were made in the course of the year. In 14 samples of tank water comma bacilli were detected.

Other Laboratory Work.—Nineteen specimens of blood were tested for enteric fever, Widal's reaction, and in 12 of them a positive result was obtained. Ten specimens of sputum were examined and tubercle bacilli were found in 3. Fifteen dead rats sent by the Plague Department and one by Messrs. Ewing and Company were examined, and plague bacilli found in 7. In one an organism resembling that of surra was found. I have found it on two or three previous occasions in Calcutta rats. One swab from the throat of a case of suspected diphtheria gave a negative result.

Out of 391 samples of ghee examined and analysed, 139, or 36 per cent., were found to be adulterated ; out of 202 of milk, 118, or 55·9 per cent. ; out of 36 of butter, 2 ; 1 of arrowroot was found to be adulterated ; out of 36 of barley powder, 26 were adulterated ; out of 7 of mustard-oil, 3 were adulterated ; 1 of cornflour was adulterated ; 3 specimens of disinfectants and 20 of a miscellaneous nature were also examined and analysed. The Analyst attended Court on 43 occasions to give evidence in adulteration cases.

A test case for the adulteration of mustard-oil was taken up at the request of the Market Sub-Committee, the Courts having on a former occasion decided that such adulteration was a necessary trade process as it was stated to be by the manufacturers. Evidence was adduced that pure oil was manufactured in the jail, and also by Messrs.

Andrew, Yule and Company, and the case was decided in our favour. Appeals against the Judgment have been made to the Sessions Court and the High Court, but have been dismissed, so it will now be possible to take action to stop this widespread practice in which most of the large manufacturers are concerned.

The question of standards is a difficulty in dairy work in India as it has been elsewhere, and allegations having been made in certain quarters that our standards were unreliable, I was asked for an explanation. Our ghee standards are based on a considerable amount of experiment, but as I quite admit that nothing like finality has been reached as regards standards for India, and the question is an important one considering the enormous quantities of ghee consumed in this country, and the prevalence of adulteration, after discussing the question with some of the leading analysts at home I recommended that a Commission should be appointed by Government, consisting of two experienced English analysts and some good Native chemists to make a tour through the country, make a long series of experiments under the varying conditions of climate and season, and report their results.

Work done by the Sanitary Inspectors.—There were 4,593 notices served for the abatement of nuisance, and 3,195 prosecutions with an aggregate fine of £725. There were 2,289 prosecutions in licence cases, with an aggregate fine of £1,300. The number of cases of disease investigated was 8,501. The number of houses disinfected was 2,972. Bedding and articles of clothing were passed through the Equifex stove and articles of no value were burnt. In addition to this, during the latter part of the year all causes of death other than suspected plague were inquired into and reported on, with a view to getting more accurate returns of the causes of death, which formed a very heavy addition to the work of the Inspectors. The licence cases alluded to above were not so much for neglect to take out licences, as for carrying on trades in insanitary premises for which licences had been refused until the sanitary defects were remedied. As there is no special course of practical training in Bengal for sanitary officers, I have recently made proposals for the establishment of such a course of instruction with examination; for certificates in connection with the Sanitary Institute and a Museum of Hygiene for teaching purposes.

ABSTRACT OF THE REPORT OF THE MADRAS MUNICIPALITY FOR 1902-03.

(*S. D. Pears, Esq., President.*)

New Drainage Works.—The laying down of the Cast Iron Main was in progress, 10,931 lineal feet were laid. The main may now be said to be nearly complete with the exception of a gap in Napier Park about 166 feet long, and another near the Mylapore Pumping Station—about 460 feet long. The construction of the engine and boiler houses, both at Ice House Road and at Napier Park House, was completed during the year.

The opening out of the two new streets—one from Wallajah Road through Chetty's Garden to Pycroft's Road in Triplicane, and the other from Wallah's Road, Narasingapuram, to Napier Park—was completed. £4,380 were disbursed to the Deputy Collector on account of compensation and other charges for the acquisition of the properties required, while £763 were recovered from the sale of superstructure of houses. Subsequently, the clearing of the sites, the raising and levelling of the street, and the construction of masonry side drains for the temporary disposal of house drainage along it, pending the laying of the new sewer eventually were done, at an estimated cost of £300 in all.

The construction of the new intercepting sewer at North Beach Road that had been commenced during the previous year, was completed and opened during the year.

The substitution of 24-inch cast iron pipes for a portion of Sewer No. 2, estimated to cost £7,700, was sanctioned by Government during the year, and pipes were imported from England and materials collected for starting the work.

Plans, sections and estimates for the sewers in the 1st, 4th, and 5th Divisions were prepared, the estimates for the 7th Division revised, and these, together with the report as well as the comparative abstract for the whole drainage scheme, were prepared for submission to the Commissioners for sanction.

Besides the above, drains were also constructed in Cemetery Road, 1st Division, and in Gate Street in Mafuskhan Garden, 3rd Division.

Water Supply.—During the year under report 11,813 yards of new pipes were laid, and 66 fountains, 70 valves, 79 stop cocks, 21 hydrants, and 28 meters were fixed. 40,630 feet of pipes were taken up, cleaned, and relaid. This brings the total length taken up, cleaned, and relaid since the commencement of these operations in September, 1900, to 322,166 feet.

On the 1st of April, 1902, the level of the Red Hills Lake stood at 40·36, and on the 31st March, 1903, at 42·89. On the 1st of August, 1902, the level of the lake fell to 35·77, when pumping had to be resorted to for the water supply of the City, and was maintained up to 5th September, 1902, when the level was raised by rainfall and pumping stopped. The lowest level to which the lake fell during the year was 35·49, the level it stood at on the 19th of August, 1902.

The quantity of water supplied to the City during 1902-03 was 594,668,979 cubic feet, against 588,280,185 cubic feet last year.

Private Services.—1,143 new services were laid by licensed plumbers during the year, and 1,951 existing services were extended. The number of new services laid, together with the total up to the end of 1901-02, makes the total of 18,267.

The quantity of water used for non-domestic purposes during the year was 106,108,020 gallons.

Vaccination.—The total number of cases vaccinated during the official year 1902-03 was 32,309, against 38,265 in 1901-02, showing a decrease of 5,956 cases due to the less number of emigrant coolies vaccinated. The results of 32,309 vaccinations performed were 27,054 successful, 2,931 unsuccessful, and 2,324 unknown.

Of the total 26,030 cases vaccinated in the Municipal Vaccine Depôts 7,609 cases were produced at the depôts for inspection of results, and in 18,421 cases the results were ascertained by the respective Division Vaccinators and the parents and guardians who failed to bring the vaccinated children for inspection under Bye-law 5 were warned to take their children to the depôts for the inspection of the Vaccinator. In 160 cases the defaulters were fined to the extent of Rs. 74-12-0 against 200 cases with a fine of Rs. 79-12-0 in 1901-02.

The percentage of success obtained both in primary and re-vaccination, excluding the unknown cases from the total, was 90·34 against 88·05 in 1901-02, showing an increase of 2·29 per cent.

The different kinds of lymph employed in vaccination during the year is given below with the percentage of success obtained in each :—

—	Total cases Vaccinated.	Percentage of Success.
Calf-to-arm vaccination	19,382	94·60
Glycerinated lymph	6,840	98·00
Lanoline vaccine	6,087	67·18

The lanoline paste used in the emigration depôts in vaccinating the emigrant coolies, who were in most cases re-vaccinated, gave a percentage of 67·18 of success against 72·88 per cent. in 1901-02.

Out of 32,309 cases vaccinated 21,898 were primary vaccination against 21,823 in 1901-02, showing an increase of 75 cases with 98·67 per cent. of success or ·29 per cent. below the previous year. The number of re-vaccinations performed amongst adults was 10,411 against 16,442 in 1901-02, showing a decrease of 6,031 cases due to the less number of emigrant coolies vaccinated during the year as compared with 1901-02. The percentage of success obtained in re-vaccination was 69·28 against 70·59 in the previous year.

The number of children vaccinated under one year was 15,092, including 68 cases which were done in the Emigration Depôts against 15,610 in 1901-02, showing a decrease of 518 cases. Of the total 44 were secondary vaccinations. The percentage of success obtained in the infant vaccination was 98·91 against 98·94 in the previous year. Of the total number of children vaccinated 11,293 were born in Madras and 3,799 were born in the moffussil.

During the year small-pox was less prevalent than in 1901-02. Cases of small-pox were also occasionally imported into the city. Infected houses were disinfected by the sanitary staff. Every possible effort was made to induce the relatives to remove small-pox patients from houses in which accommodation was insufficient to the isolation hospitals, and the infected houses were visited by the vaccine staff to vaccinate the unprotected children found in the neighbourhood. Re-vaccination was also encouraged in the infected areas, and those who were willing to undergo the operation were vaccinated.

Vital Statistics.—During the year 1902 there were 17,743 births, exclusive of still-births registered in the city, which is a decrease of 1,129 on the previous year and gives a birth-rate of 34·8 per 1,000 of the population, the birth-rate for 1901 and the average of the ratios for the decade being 37·0 and 40·6 respectively. This decrease may be accounted for by the high price of food and the prevalence of epidemic disease in 1901, both of which seriously affect the health and vigour of the population and therefore its fecundity. Other influencing agents also seemed to have been at work. In comparing the relative proportion of males to females according to the four previous Census returns, it was noticed in the Administration Report for 1900-01 that the female population, once in excess, has steadily declined, and according to the last Census return the male population was in excess of the female population by 5,199. Other things remaining the same, a decrease in the number of females must result in a concomitant decrease in the number of births. Of the 17,743 births, 9,066 were males and 8,677 were females, giving a proportion of 100 female births to every 104·4 male births.

Deaths.—The total number of deaths registered from all causes in the City during the year 1902 was 21,395, which gives a death-rate of 42·0 per thousand of the population per annum. This compares very favourably with those of the two preceding years, which were 55·0 for 1901 and 46·2 for 1900, and is a trifle more than the average of the ratios for the decade, which is 41·8. Of the total deaths, 10,915 were males and 10,480 were females, giving the proportion of 104·1 males to every 100 females. The mortality fell most heavily on infants under one year of age, "60 and over" coming next in order.

Mortality according to Divisions and Wards.—The 1st and 2nd Divisions returned the highest rates with 48·7 each per 1,000 per annum and next in order is 3rd Division with 44·1. Among the wards 1st Division, Centre Ward returned the highest death-rate with 57·1 per 1,000 per annum. Next comes 2nd Division, South, with 53·3 followed by 3rd Division, Centre, with 49·3. If the average of the death ratios of the decade is taken, the same order is preserved, viz., 1st Centre takes the lead with 58·2 per 1,000, 2nd South comes second with 50·7 and 3rd Centre and 2nd North come next bracketted with 43·5. 4th Division returned the lowest death-rate during the year under report, viz., 30·9 per thousand, while the average of the ratios of the decade gives the lowest place to 6th Division, South Ward, with 33·3 per 1,000.

There is no doubt that 1st Division, Centre Ward, has been and is the most unhealthy spot in the whole City. It comprises chiefly the Hutting grounds of Ropegodown Paracherry, Singara-garden, and Tinnevelly Settlement. The 1st of these three is not drained at all with the result that the whole of the hutting ground is practically one mass of sewage. The streets are narrow and are literally used as latrines by children in the day and adults after dusk. Low built mud-walled houses with no proper flooring, in such a dangerously polluted soil, must of necessity affect the death-rate of the place. It is literally a case of "Excrement-sodden earth, excrement-reeking air and excrement-tainted water" and no wonder therefore that it is the home of cholera and other epidemic diseases. What is said of the Ropegodown Paracherry may equally apply to Tinnevelly Settlement and Singara-garden, with the addition that in these two hutting grounds a very filthy trade that of paddy boiling is extensively carried on. The water in which the paddy is soaked is as much if not more offensive than even sewage, and the greater part of it soaks in the ground.

The arrangement of houses in this settlement is peculiar, two rows of rooms are built either side with an open yard in the centre closed in by a wall at either end or by another set of rooms. The open yard is for drying paddy and the row of rooms on one side is let to the paddy pounders, one family occupying each room of less than 500 cubic feet, while the opposite row the owner and his family occupy. One end of the open yard is occupied by earthenware tubs to soak paddy in. Some 50 to 100 persons huddle together in one such house and the insanitary condition of which may be easily imagined. The complete removal of the trade from the place although it would be a great hardship on the settlers seems to be the first step towards effecting an improvement in the condition of the place. The 1st Centre Ward is the most feverish centre in the City in addition to being the haunt of all sorts of epidemic diseases that from time to time occur in the City. Very large part of the population of these 3 hutting grounds—strange as it may seem—still cling on to their wells for their water-supply. 2nd Division, South Ward, is in many respects quite unlike the 1st Centre, although it is almost equally insanitary. The greatest defect of the 2nd Division, South, is the extreme overcrowding, in what may be correctly termed dark dungeons. Less than a third of a square mile in area, 2nd South, has a population of 22,304 people. Most of the houses have but one floor, and the rooms in most houses are almost dark in the day. The streets are in most cases far too narrow and run from north to south effectually shutting off all sea-breeze. The streets running north and south of Rasappa Chetty Street are particularly bad in this respect. The filthy cattle yards of Yadapallium must also contribute to the enhanced death-rate. The streets are provided with open drains, but there is a lot of stagnation of sewage and they are very freely made use of as public latrines. Third Centre and 2nd North approach 2nd South very much in their general arrangements.

Under the Act, the municipality has no power to alter existing buildings and any improvement of the buildings already existing, is therefore at present out of the question. There is provision in the Act to interfere in the case of overcrowding, but so long as no provision is made for housing the poor either by the municipality or by private enterprise, no permanent good can result from enforcing the Act, as it will only drive people from

one tenement house to another. The question of widening and opening cross streets must sooner or later receive the attention of the Commissioners.

Cholera.—Total number of deaths from this disease was 37 of which 24 occurred in January, February and March as a fragment of the outbreak of 1901. The remaining 13 cases were either sporadic or imported, the latter counting the majority.

Small-pox.—The total number of deaths from this disease during the year 1902 was 69 against 292 in the year previous.

Fever.—This heading conveys practically no information, as the number of diseases in which fever is a prominent symptom is large and varied, 7,326 deaths were returned as due to fever, against 9,151 last year but it is more than the average of the decade which is 6,129. It is not possible to say anything more than repeat what has been said in the reports of previous years, viz., that so long as registration remains in its present defective condition, no opinion as to the real causes that led to this high mortality is possible. Malarial fever and phthisis no doubt contributed largely to the total, but pleurisy, pneumonia, typhoid, rheumatic fever, affections of the liver, &c., added their quota. Among the other diseases attended with fever, dengue, a disease which was epidemic in the City from April to October appears to have contributed to this increase. Although ordinarily attended with very little fatality, dengue is not altogether without casualty especially in the weak, aged and young, and more so when through unskilful management or imprudence complications set in. It is not therefore unreasonable to suppose that a disease which laid its burden on almost every one, contributed, even a little, to the mortality of the town. The actual number of deaths registered from dengue are only few. Dengue made its appearance last time in the City in 1872 and now after a lapse of thirty years it again made its appearance about the beginning of the year. The disease appears to have been imported into the City from Burmah where it prevailed in a severe form. A disease peculiar to hot climates, dengue always spreads in the hot months and dies out with the onset of the monsoon and the cold weather. Practically very little was heard of the disease after the beginning of November. A few cases of the disease known as epidemic dropsy were also reported during the year. With regard to prevalence of fever in the different parts of the City—2nd Centre returned highest rates during the year under report and 1st Centre comes next. If the average of the ten previous years be taken 1st Centre stands far ahead of the rest.

Bowel-complaints.—There were 2,789 deaths from dysentery and 572 from diarrhœa against 4,099 and 771 respectively in the year previous. The ratio of deaths from dysentery was 5·4, from diarrhœa 1·1 against 8·0 and 1·5 respectively in the previous year.

Infantile Mortality.—The death-rate among infants under one year of age was 303·9 per 1,000 births against 328·3 of the preceding year and the ratio calculated on the infantile population was 395·1 against 454·0 of the previous year. This ratio although better than last year is still very high and the general ignorance with regard to the management of births and babies and a lack of all knowledge of infant hygiene, together with insanitary conditions which obtain in the City, account for this high rate being kept up.

Plague Measures.—The services of the Plague Officer were dispensed with at the beginning of the official year, and to supervise the Passport Staff, the Special Sanitary Inspector on Plague duty was appointed Superintendent of Passports. The number of persons detained during the year at the several Plague Camps in the City was :—At Perambur, 3,119 ; at Washermanpet, 179 ; and at Egmore Plague Hospital, 208. 13 cases of plague occurred in the City during the year—all of which were imported. Of these 10 were removed and treated in the Egmore Plague Hospital and the other 3 died at their residences. Of the 10 cases treated in the Hospital, 3 recovered. Of the 13 cases, 6 were imported from Adoni and 3 from Kolar District.

The total number of passports issued at Perambur during the year was 68,471 against 55,120 in the year previous. The excess was chiefly due to the large increase in the number of notified places. The number of passport holders untraced was 1,065 against 1,224 in the previous year giving a precentage of 1·65 against 2·44. The number

of moffussil passports received was 11,017 against 8,079 of the preceding year. Of these 11,017—512 could not be traced giving a percentage of 4·64. The percentage of the untraced last year was 6·39.

The attendance of passport holders was satisfactory. Amongst 64,212 passport holders there were only 164 prosecutions and 112 convictions against 50,171 passport holders, 339 prosecutions and 178 convictions last year. The fines inflicted amounted to Rs. 386 against Rs. 591-12-0 in the year previous.

The Port Health Officer reports as follows with regard to the plague inspection of vessels :—318 vessels, departures from Madras, carrying a crew of 27,783 persons and 31,844 passengers were inspected during the official year 1902-1903 and granted Bill of Health. The inspection of the crews and passengers was carried out on shore. Besides these, 186 vessels, arrivals from plague infected ports, and carrying a crew of 13,624 men and 2,620 passengers for Madras were inspected on Board before communication between the vessels and shore was permitted. All passengers landing at this port are granted plague passports. On board these 186 vessels 11,600 shore coolies worked. Before being sent on board the names and addresses of the coolies are taken down and on their return in the evening they are given a disinfecting bath of perchloride of mercury. Such coolies as are absent on the following morning are inspected at their homes under the orders of the Municipal Health Officer.

ABSTRACT OF THE REPORT OF THE MUNICIPAL COMMISSIONER FOR THE CITY OF BOMBAY FOR 1902-03.

(W. L. Harvey, Esq., C.I.E., Municipal Commissioner.)

PUBLIC WORKS.—*Drainage.*—The machinery at the Colaba Compressor Station and the several Ejector Stations worked satisfactorily during the year.

The engines and pumps at the Love Grove Pumping Station worked satisfactorily during the first half of the year. In the month of October, however, it was discovered that the efficiency of the pumps had fallen considerably, and that they were not capable of keeping down the sewage in the main sewer to the usual level. Steps were immediately taken to set the matter right.

The street portions of house-drainage connections carried out departmentally numbered 530 at a cost of £1,946.

Several latrines and urinals have been constructed at different places to meet the public convenience.

Works in connection with the sanitary arrangements of the various Health Camps, Observation Camps and Plague Hospitals were carried out by the Drainage Department, Ordinary Branch.

Several works executed by the Drainage Department, Special and Ordinary Branches, have been detailed in the Executive Engineer's report.

WATER WORKS.—*Tansa Lake.*—The rainfall for 1902 was 89·87 inches against 96·15 inches for 1901. The total quantity of water received in the lake was 34,531 millions of gallons or 50·4 per cent. of the rainfall on the catchment area of 52·5 square miles.

Vehar Lake.—The rainfall for the year 1902 was 72·92 inches against 75·58 inches during the preceding year. The total quantity of rain which fell on the whole of the drainage area of 3,900 acres was about 6,483 millions of gallons, of which about 5,335 millions of gallons or about 83 per cent. of the total rainfall reached the lake. There were 4 bursts on the 32″-main between Curry Road and Mátungá, and 2 bursts north of the Coorla Station.

Tulsi Lake.—The rainfall for 1902 was 93·19 inches against 93·62 inches for 1901. The total quantity of rainfall on the whole drainage area of 1,700 acres was 3,623 millions of gallons, of which about 1,810 millions of gallons reached the lake—this is about 50 per cent. of the total rainfall. There was 1 burst near Marole in the Tulsi 24″-main.

Supply and Distribution.—One 9″-main has been laid as an additional supply main in the De Lisle Road from its junction with Carrol Road and a 4″-main, about 1,200 feet in length, has been laid in the Wodehouse Bridge Road. There were 116 bursts in various mains, of which 42 were caused by the operations of the drainage contractors. 405 new connections were made, and 274 connections were cut off for various reasons. The total number of connections at the end of the year was 20,683, and the number of meters in use was 3,202.

Public Health.—The state of the public health during the year was better than in the preceding year, the number of deaths, exclusive of still-born, being 48,414 against 59,495 for the previous year. There were 13,820 deaths from plague against 18,736 during 1901. The number of births registered during the year was 17,599, being 4,079 more than in the past year.

ABSTRACT OF THE REPORT OF THE HEALTH OFFICER OF BOMBAY CITY FOR 1902.

(*Dr. John A. Turner.*)

Births.—The number of births registered during the year was 17,599, being 4,079 more than in the previous year and 6,209 more than the average of the preceding five years, giving a birth-rate of 22·67 per 1,000 of population against 17·42 during the corresponding period of the last year ; of the total number of births 9,154 were males and 8,445 females, and 2,017 still-born births. From this it will be seen that there was a marked improvement in the registration of births. The birth-rate amongst Parsees was 24·55 and amongst Europeans 11·81 as against 24·65 and 11·97 respectively during the last year.

Mortality.—The number of deaths in the City of Bombay during the year 1902, exclusive of still-born, was 48,414, being 11,081 less than in 1901 and 10,613 less than the average for the past five years, giving an annual death-rate of 62·38 per 1,000 of the population.

The mortality during the year under report was the lowest of the previous corresponding period of any year since 1898 as shown below :—

Years.	Total number of deaths.
1898	51,961
1899	56,434
1900	79,350
1901	59,495
1902	48,414

Plague.—During the year the control of all plague measures was under the Health Department. The mortality from plague began its seasonal rise in January and reached its maximum on the 3rd of April and then declined. There were 16,423 attacks and 13,820 deaths from plague during the year as against 21,006 attacks and 18,736 deaths during the last year. As in previous years the general Hindu community suffered severely from plague, the mortality amongst this class being 8,597 as against 12,418 during the last year. There was a decrease in the number of deaths from plague in all the communities except Europeans and Negro-Africans, who show 13 and 9 cases as against 10 and 6 respectively during the last year. There was a marked reduction in the number of deaths from plague in all the sections of the City except Upper Colaba, Fort, Southern and Chaupati.

A total of 9,159 deaths took place amongst males and 4,661 amongst females as against 12,611 and 6,125 respectively during the last year.

The highest plague mortality was recorded in the month of March, the number being 3,609, April coming next with 2,800 ; the lowest mortality was in July, 129 deaths being recorded. From August the plague mortality rose gradually to the end of the year, 570 deaths being recorded in December, 1902. The plague mortality was highest on the 3rd of April, 148 deaths being registered on that date, while on the 30th of March the highest daily mortality for the year was recorded, viz., 287.

Causes of deaths compared.—In the following table it will be observed that there has been a marked decrease in the number of deaths from all diseases except small-pox and measles, which stood higher amongst them as compared with the figures of the previous year.

TABLE SHOWING THE NUMBER OF DEATHS AND THE DEATH-RATE FROM DIFFERENT CAUSES IN 1901 AND 1902.

Cause of Death.	1901.		1902.	
	Number of Deaths.	Death-rate per 1,000 of Population according to the Census of 1901.	Number of Deaths.	Death-rate per 1,000 of Population according to the Census of 1901.
Small-pox	159	·20	288	·37
Measles	67	·08	642	·82
Fevers	7,921	10·20	4,518	5·82
Cholera	198	·25	75	·09
Plague	18,736	24·14	13,820	17·80
Phthisis	6,516	8·39	3,957	5·09
Diseases of the Nervous System	2,971	3·82	3,027	3·90
„ Respiratory System	7,804	10·05	7,250	9·34
Diarrhœa	2,375	3·06	2,266	2·92
Dysentery	1,341	1·72	1,377	1·77
Accidents	764	·98	732	·94
All other Causes except Still-born	10,643	13·71	10,462	13·48
Total	59,495	76·66	48,414	62·38

By sexes, 27,826 males and 20,588 females died during the year. The highest number of deaths amongst males occurred in the age-period between 25 to 30 years, 3,222 deaths having been registered, and amongst females 2,034 in the age-period of 15 to 20. The lowest number of deaths amongst males occurred in the age-period between 4 to 5 years, 235 deaths having been registered, and amongst females 246 in the age-period of 3 to 4 years.

The death-rate by classes.—The death-rate by classes is shown in the following table. It will be seen from this that the Jain community, which includes Banias, excepting Negro-Africans, Buddhists, and Lingaets, who form very small communities, show the highest mortality, viz., 137·14 per 1,000 of population. Next comes Hindus, low-caste, the death-rate being 75·59. The general mass of the Hindu Community give a death-rate of 63·03 and Mussalman 65·82. The death-rate amongst Parsees was 30·41, European death-rate being more than the last year, viz., 21·99 as against 15·39 during the last year.

Small-pox.—Two hundred and eighty-eight deaths from small-pox occurred during the year, as compared with 159 in 1901 and 746 during the average of the preceding five years. The disease did not assume an epidemic form until late in the year. It was brought to my notice that a large number of unvaccinated people from the Portuguese territories, especially from Goa, were coming to Bombay, and most of them, soon after their arrival here, were found suffering from small-pox, and thereby spreading the disease in the city. I then addressed a letter to the Consul-General for Portugal, enquiring whether vaccination is compulsory in the Portuguese towns, especially in Goa, and in reply he sent me a copy of the letter received by him from the Chief Secretary of the Government of Goa, that, according to Government Resolutions dated 11th February, 1883, and 24th July, 1896, vaccination is compulsory, but there is no restriction on those who leave the country, and that they are not subject to special observations. I also addressed a letter to the Municipal Commissioner, bringing to his notice the prevalence of small-pox among the Goanese in Bombay. Handbills in Gujarathi and Marathi for the prevention of the spread of small-pox in the city were distributed to the public.

Cholera.—From cholera 75 deaths were registered during the year, as compared with 198 in 1901 and 1,190 during the corresponding year of the last five years. The disease did not assume an epidemic form. The highest number of deaths from this disease was registered in the month of March. Of the total number of deaths, 47 occurred amongst Hindus of other castes, as against 131 during the last year ; 13 amongst Mussalman, as against 18 during the last year. Eighteen deaths occurred amongst persons who had resided in Bombay for three months and under, and eight deaths amongst those who resided in Bombay for six months and under. Out of the total of 75 deaths, 65 occurred amongst persons born outside of Bombay.

Fevers.—A total of 4,518 deaths was registered from fevers. Remittent fever claims the highest number, viz., 3,847, being 3,419 less than in the last year, and 1,938 less than the average of the preceding five years. To simple continued fever 99 deaths were registered, being 14 less than in the last year, and 171 less than the average of the previous five years. To enteric fever 89 deaths were ascribed, being 27 more than the last year, and 42 more than the average of the last five years. To ague 483 deaths were registered, being three more than the last year, and 190 more than the average of the last five years. It will be observed that the fever mortality rose and fell with the mortality from plague. It commenced rising from January to March, when the highest number of deaths, viz., 868, was registered. The highest number of deaths from plague registered in the month of March was 3,609. From the month of April fever gradually decreased till the end of the year.

Excluding Jains, which form a very small community, there was a slight increase amongst Lingaets, Bhatias, Europeans, Eurasians, and Negro-Africans, the rate being 5·59, 6·12, 4·39, 4·60, and 4·79 respectively, as against 3·26, 3·54, 2·60, 2·14, and 1·59 respectively in the previous year. The general mass of Hindu community show a very remarkable decrease, the rate being 6·02, as against 13·42 in the previous year. Mussalman give a death-rate of 5·21 as against 6·60 in the last year.

During the year investigations into the prevalence of malarial fever were made, and report submitted to the Corporation. The divisional health officers instructed their staff into the methods of distinguishing the various mosquitoes and larvæ, and a list of places was made out where anopheles larvæ were found.

To relapsing fever 651 deaths were ascribed, being 909 less than in the last year, and 167 less than the average of the preceding five years. The highest number of deaths from relapsing fever was registered in the month of February, when 103 deaths were registered. From March the disease gradually decreased till the end of the year.

Measles.—From measles 642 deaths were registered during the year, being 575 more than the last year and 228 less than the average of the preceding five years. The disease prevailed in an epidemic form during the last two months of the year.

Phthisis.—From phthisis 3,957 deaths were registered during the year, being 2,559 less than the last year, and 2,502 less than the average of the last five years. The most fatal period of life amongst males was between the ages of 25 to 30, and that of females between the ages of 20 to 25. The female death-rate was more than double that of male. Leaving out Negro-Africans, which is a small and fluctuating community, the mortality from this disease was high amongst Jains, but less than the last year, the rate being 11·22, as against 18·80 in the last year. There is a decrease in the number of deaths amongst Mussalman, the rate being 8·52, as against 13·89 in the last year.

Infant Mortality.—The number of deaths amongst children under one year of age was 9,553, being 1,785 more than in the previous year ; of these, 8,399 deaths took place amongst the children born in Bombay, and 1,154 amongst those born out of Bombay. The number of births registered during the year was 17,599, giving an infant mortality of 537·13 per 1,000 of the births. Small-pox and measles accounted for 87 and 205 deaths of infants under one year of age respectively. Diseases of the respiratory system are stated as being responsible for 2,347 deaths amongst infants under one year of age, as against 1,536 in the last year, while under the head of "diarrhœa" 617 deaths are given, as against 484 in the last year. The other causes given are :—Diseases of the Nervous System "Convulsions" (2,023), and debility (3,025) ; of the latter, 2 232 deaths were under 30 days.

General.—From diseases of the digestive system, 4,744 deaths were registered, being 128 less than in the last year, and 1,293 less than the average of the preceding five years ; of these, 2,266 were ascribed to diarrhœa, being 109 less than in the last year,

and 619 less than the average of the last five years. To dysentery, 1,377 deaths were registered, being 36 more than in the last year, but 461 less than the average. To all other diseases of the digestive system, 1,101 deaths were registered, being 55 less than in the last year, and 213 less than the average.

Nervous Diseases.—To diseases of the nervous system, 3,027 deaths were registered, being 56 more than in the last year, and 21 more than the average. Out of the above number, 2,314 deaths were due to infantile convulsions.

Respiratory Diseases.—From diseases of the respiratory system, 7,250 deaths were registered, being 554 less than in the last year, and 213 less than the average; of these, 4,001 deaths were referred to bronchitis and 1,867 to pneumonia.

Circulatory Diseases.—To diseases of the circulatory system, 364 deaths were referred, being 67 more than in the last year, and 48 more than the average.

APPENDIX.

No. 1.

MEMORANDUM by the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER with the GOVERNMENT of INDIA, for 1902.

The brief sketch given of its chief meteorological features shows 1902 to have been a comparatively dry year, the rainfall for India, as a whole, having been somewhat less than the annual mean. Accompanying this dryness, there was a decrease in the prevalence of malarial fevers amongst the troops and prisoners. Over the greater part of India the temperature of the year was above normal, a condition accompanied by an increase in the number of admissions and deaths from heat-stroke amongst the European troops as compared with that recorded in the previous year.

2. The average strength of the European Army of India has varied but slightly during the past three years. In the year under report it was 60,540. The health of the troops is described in the Army Medical Department Report as having been exceptionally good; but the death-rate rose from 12·38 in 1901 to 14·68 in the year under report. The disease which contributed more than any other to this increase was enteric fever. From 3·32 per thousand of average strength in 1901, the death-rate from this cause rose to 4·29. Abscess of the liver and pneumonia were also more fatal than in 1901. Between them, enteric fever and abscess of the liver caused 41·8 per cent. of the deaths from all causes as compared with 37·8 per cent. in the previous year. Although the death-rate was considerably higher, the admission-rate, the constantly-sick-rate, and the invaliding-rate were all lower than in 1901. As usual, intermittent fever and venereal diseases were the chief causes of admissions, the former accounting for 22·9 per cent., and the latter for 26·0 per cent. of the admissions from all causes. In the previous year, intermittent fever was responsible for 26·5 per cent., and venereal diseases for 24·9 per cent., of the admissions, showing that whilst the former was considerably less prevalent, the latter was somewhat more prevalent in the year under report. These two diseases, although the cause of so high a proportion of the admissions, had comparatively few deaths directly ascribed to them, ague being credited with 30 and secondary syphilis with 15 deaths out of a total of 889 for the year. Together with debility, they were the cause of 810 of a total of 2,255 invalidings.

3. Of the four Commands, Bombay was the most unhealthy, with a death-rate of 19·58 per thousand of strength, as compared with a death-rate of only 8·92 in Madras, the healthiest Command. To the high death-rate in the Bombay Command, enteric fever contributed no less than 5·69 and circulatory diseases 2·57; these two diseases accounting, respectively, for 1·71 and ·54 in the Madras Command. But with, by far, the lowest death-rate, Madras recorded a higher admission rate than any of the other Commands excepting Bombay. This was chiefly due to the comparatively greater prevalence of venereal diseases in the Madras Command.

4. Of the chief diseases, *influenza* and *cholera* showed a much diminished prevalence in the European Army, the admissions from the former having fallen from a ratio of 8·9 per 1000 the previous year, to 1·8 with only one death; whilst of cholera there were only three cases, all of them fatal. The decrease in the prevalence of cholera was not confined to the European Army, but extended also to the Native Army, to the prisoners, and to the general population. Whilst the ratio of deaths from cholera was ·05 per thousand in the European Army, it was 0·12 in the Native Army, 0·21 amongst the prisoners, and 1·01 amongst the general population. In the great cholera epidemic year of 1900, the death-rate in the European Army was 1·45, in the Native Army 3·16, amongst the prisoners 2·28, and amongst the general population 3·7. These figures appear to show that a rise or fall in the general prevalence of cholera affects all classes of the population, European and Native. In the year under report, the European Army suffered proportionately less in comparison with the rest of the population of the country than it did in 1900. This may be taken as an indication of the more rapid progress of sanitation as applied to the prevention of disease amongst European troops, than amongst the rest of the population. The epidemics of cholera, which, in the not remote past, proved so destructive of life in the European and Native Armies, still continue to carry off large numbers of the general population. If it were practicable to apply them, there is no reason to doubt that the measures which have proved successful in preventing the recurrence of these epidemics amongst the troops, would be found equally successful in preventing them in the case of the general population.

5. It is contrary to what might have been expected to find *small-pox* more fatal in the European than in the Native Army. In the former, 23 attacks with four deaths were recorded; whilst in the latter, although 75 men were attacked, there were only two deaths. Moreover, the Native was more than double the numerical strength of the European Army. It is stated with regard to the European soldier who died of small-pox at Meerut that he had been twice vaccinated, the last time in 1898; but it is not mentioned if the latter operation was successful.

6. There was a marked decrease in the prevalence of *intermittent fever*, the ratio of admissions falling from 293·2 in the previous year, to 247·1 per thousand of strength in the year under report. It is stated that in nearly all the stations in which a decrease in the admission rate on account of ague occurred, the medical officers attribute the decrease partly, or wholly, to measures taken to prevent the breeding of *anopheles* mosquitoes by applying kerosene oil to pools and other collections of water. But it is pointed out by the Sanitary Commissioner with the Government of India that a decrease in the

prevalence of intermittent fever during the year under report was noted in the majority of stations throughout India, and not only amongst British troops, but amongst Native troops and prisoners as well. The experiment, commenced in April, 1902, and carefully carried out under expert supervision at Mian-Mir, does not encourage the hope that operations having for their object the destruction of mosquitoes will be effectual in putting an end to, or even materially diminishing, malarial fevers. The report on the anti-malarial operations at Mian-Mir, 1901–03, ends :—"Moreover, it appears to us "that gradual but permanent improvement in the health of stations by well directed sanitary reforms, "wherever these can be carried out, will in the end yield the best return."

7. The steady decrease in the mortality from *enteric fever* in the European Army of India, which has been taking place from year to year since 1898, has at length received a check. In the year mentioned, the death-rate reached by this disease was no less than 10·17 per thousand of strength ; from which high rate it fell to nearly half in the following year, and more slowly in 1900, until in 1901 it was only 3·32. The decrease was believed to be due mainly, if not wholly, to the lessened influx of young soldiers from England during the continuance of the Boer war. This belief seems to be confirmed by the increase which began to take place in the death-rate from enteric fever when the despatch to India of the usual annual drafts was resumed. From 3·32 in the previous year, the ratio of deaths per thousand of strength has already risen to 4·29 in the year under report. An examination of the tables on page 34 of the Appendix to the Report, shows that in 1898, when the enteric death-rate was 10·17 per thousand of strength, 54 per cent. of the soldiers were under 25 years of age, and 81 per cent. of them had been in India less than five years ; whilst in 1901, when the death-rate had fallen to 3·32 per thousand of strength, only 42 per cent. were under 25 years of age, and 63 per cent. of them less than five years in India. In the year under report, when the enteric fever death-rate has begun again to rise, the number of men who arrived from England has risen from 18,594 in the preceeding year, to 24,840 ; whilst at the same time, the percentage of men under 25 years shows a slight decrease, and that of men of less than 25 years of residence in India an increase from 63 to 68. The Report gives, as usual, an excellent *résumé* of the progress of research into the nature or entity of enteric fever and its etiology. The perusal of another year's record of scientific investigation tends to suggest the need for caution in accepting some of the conclusions hitherto regarded as permanently established on a secure basis. The "solely waterborne" theory of the causation of enteric fever is held by a diminishing number of observers. "That enteric fever is frequently communicated by direct "infection from one case to another is now recognised on all sides." Koch considers this to be perhaps the most important of all methods by which typhoid fever is disseminated. In his successful campaign against the disease at Treves he found that all the cases were to be referred to contact ; the "infection was always carried directly from one person to another and no trace of a connection with "water was to be found." The detection of the bacillus in water is now acknowledged to be a matter of extreme difficulty. In last year's *memorandum* it was noted that Sims Woodhead had only once been able to isolate the bacillus from water, and in that case he had placed it there himself. After much experience, Koch states that in his recollection he has only once been able to prove the presence of the bacillus in a suspected water. The infallibility of the Widal reaction as a test in the diagnosis of enteric fever is called in question by several observers. It is said often to fail in mild cases, or to make its appearance too late in the course of the disease to be more than an aid to diagnosis. "The "fact that no cases were returned as enteric fever unless they gave the Widal reaction, is assigned as a "reason for the decrease of the number of cases at Mhow and some other stations. At Mhow, although "for this reason the number of admissions was about half that of the previous year, the death-rate was "nearly double ; and the medical officer considers that in 1901 a number of cases were wrongly "diagnosed as enteric fever—the small percentage of deaths and the monthly distribution pointing to "this." Such instances indicate the uncertainty which still prevails in the diagnosis of enteric fever and may help to explain some of the wide differences in the ratios of admissions, and in the percentage of deaths to admissions, disclosed by the returns in certain stations and hospitals.

8. The resumption of the despatch to India of the usual annual drafts of troops, which had been interrupted during the war in South Africa, appears to have affected the prevalence of *venereal disease* in the same way as that of enteric fever. The steady decrease in the ratio of admissions from venereal disease from 522·3 per thousand of strength in 1895, to 276·0 in 1901, not only received a check but was replaced by a slight increase in the year under report, when it rose to 281·4. The admission-rate was much above the average for the European Army as a whole, in the Madras Command, and much below it in the Punjab Command, having been in the former 343·4, in the latter 217·5. Yet the rate for the Madras Command is considerably below that recorded in 1901, when it was 372·8. In Cannanore the rate rose to no less than 689·2 per thousand ; but the average strength of the garrison was only 74. The increase at this station was attributed by the medical officer to the absence of any restriction with regard to prostitution, and to there being no cantonment hospital where diseased women can be treated—a description of local conditions, with their attendant consequences, which might not be unworthy the consideration of those who advocate the abolition of all measures specially designed for the protection of the soldier against venereal diseases.

9. Excepting *abscess of liver*, none of the other diseases were unusually prevalent or fatal. Although wide-spread and fatal amongst the general population, *plague* attacked but four European soldiers during the year, and of these only one died. Abscess of the liver accounted for 112 deaths, as compared with 83 in the previous year. At some stations the disease was the cause of high ratios of admissions and mortality. In the garrison at Barrackpore, with an average strength of 343, there were 18 admissions with 10 deaths from hepatic abscess. "The medical officer states that most of the men who died from abscess of the liver were said to be heavy drinkers."

10. The average annual strength of the *Native Army* during the year under report was 124,231, or somewhat greater than during the previous year. Its health was good, although, as in the case of the European Army, there was some increase in the death-rate, which was 11·16 per thousand, as compared with 10·68 in 1901. The disease which caused by far the highest percentage of total deaths was again *pneumonia*. To this were ascribed 33·2 per cent. of the total mortality for the year. If

to deaths from pneumonia are added those from *tubercle of the lungs* and *other respiratory diseases*, the combined percentages of deaths due to them mount to 43·5 of every hundred from all causes. The contrast between the European and Native Armies of India in respect of the incidence and fatality of respiratory affections is striking. Whilst in the former these were accountable for a percentage of only 12·4 of every hundred deaths, in the latter they were accountable for a percentage of 43·5. These figures seem to suggest the nature of the sanitary improvements calculated to lessen the prevalence of the diseases to which mortality amongst the Native troops is in great part due. If to the diseases mentioned are added *remittent* and *intermittent fevers*, which together accounted for a percentage of 18·2 in every hundred deaths, no other one disease was credited with a higher percentage of deaths than 3·5.

11. In both the Native and European Armies *intermittent fever* contributed, as usual, a large proportion of the admissions into hospital. In the former this amounted to 274·5 of a total admission-rate of 718·0. To the prevalence of *venereal diseases* amongst the European troops was mainly due the wide divergence between the admission-rates in the two armies. In the European Army these diseases accounted for an admission-rate of 281·4 per thousand of strength, and in the Native Army for only 32·8. Had the European troops suffered from venereal diseases in the same proportion only as the Native troops, the admission-rate for the former would have been, not 1,078·4, but 829·8, as compared with 718 for the latter.

12. *Cholera* was again in comparative abeyance in the Native as well as in the European Army. There were only 26 cases with 15 deaths, as compared with 35 cases and 19 deaths in the preceding year. *Enteric fever* was credited with having been the cause of 50 admissions with 12 deaths, as compared with 24 admissions and 15 deaths in the previous year. The difference between the ratios of deaths to admissions for each of the two years is striking, and would suggest either a much milder type of the disease or, what is more probable, greater, or less, accuracy in the diagnosis of cases recorded as enteric fever. The contrast between the European as compared with the Native soldier in liability to die from enteric fever continues to be as marked as ever: whilst the death-rate ascribed to enteric fever was 0·10 in the Native Army, it was 4·29, or more than forty times greater, in the European Army. A further decrease in the prevalence of *venereal diseases* is recorded in the Native Army. The ratio of admissions, which had risen to 42·5 in 1900, fell in 1901 to 34·3, and now in the year under report, still further to 32·8 per thousand of strength, as against 281·4 in the European Army. *Abscess of the liver* is another disease from which the Native soldier is comparatively exempt. Whilst amongst the Native troops there were only 13 admissions with eight deaths from abscess of the liver, there were 198 admissions with 112 deaths from this cause amongst the European soldiers, although the average numerical strength of the latter was less than half that of the former. *Dysentery* and *diarrhœa* were both somewhat more prevalent amongst the Native troops than in the previous year. Whilst, as already mentioned, there were only four cases of *plague* with a single death amongst the European troops, there were amongst the Native troops 192 cases with 95 deaths. The greatest number of cases occurred amongst the troops stationed at Bangalore. Of 33 cases occurring in one regiment at that place, 14 had been inoculated, and of these six recovered, five died and three remained under treatment at the end of the year. Of the remaining 19 uninoculated cases, three recovered, 14 died, and two remained under treatment at the end of the year. If these figures may be taken as a measure of the prophylactic effects of anti-plague inoculation generally, they can scarcely be regarded as affording much encouragement to those who would trust to it alone for stamping out the disease.

13. The average number of *prisoners* in jail, which had been 121,812 in 1900, and 117,203 in the following year, fell in the year under report to 114,334. This decrease of the jail population may be taken to indicate that more prosperous times have been succeeding seasons of scarcity and famine. In accordance with what was to be expected, the return of prosperity was accompanied not only by a decrease in the number of prisoners, but by an improvement in their health. The climatic conditions of the year, which was hot and rather dry, were also, on the whole, favourable to health. The jail death-rate, which had been 34·27 in 1900, fell to 26·59 in the following year, and still further in the year under report to 24·61. Of the chief diseases *cholera*, as in the case of the troops and general population, was less fatal amongst the prisoners than in the previous year, the number of deaths ascribed to it falling to 24 from 103. Regarding the outbreaks amongst the prisoners at Benares and Ghazipur, it is stated that their origin could not be traced; but at both places the free population was suffering from cholera at the time when the disease appeared in the jails. This is still the usual experience throughout India. *Enteric fever* was less fatal than in the previous year, the number of cases decreasing from 20 in 1901 to 15 in the year under report. At the same time the admissions ascribed to enteric fever increased from 41 in the former year to 69 in the latter;—figures which might suggest change in the type, or treatment of the disease, but may rather have been due to change in methods of diagnosis. In any case, the records show that enteric fever is productive of a share of the mortality in the Native Army and jails which is insignificant when compared with that of which it is the cause in the European Army of India. The chief causes of mortality in jails were, as usual, *dysentery* and *diarrhœa*, *tubercle of the lungs* and *pneumonia*. To these were due 57 out of every 100 deaths amongst the prisoners during the year under Report. Repeating a remark in a former Report by the Sanitary Commissioner with the Government of India:—"The heads of jail mortality requiring special "attention are bowel complaints, tubercle of the lungs, and respiratory diseases." Taking into account the widespread prevalence of *plague* amongst the general population, the occurrence of only 37 cases with 20 deaths testifies to the success of the measures adopted to exclude the disease from the jails. *Cerebrospinal fever* was accountable for 108 deaths, as against 102 in the previous year. The number of cases of the disease at the same time decreased from 141 in the previous year to 130 in the year under report. The serious increase of cerebrospinal fever noted in the preceding year has not, therefore, continued. The existence of this form of fever amongst the free population is said now to be acknowledged; and measures are taken by the medical officers to prevent infection from being imported into the jails under their charge.

1st October, 1904.

No. 2.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Bengal for 1902.

Although Major Clarkson, I.M.S., writes the Report, he was in charge of the duties of Sanitary Commissioner during no part of the year with which it deals. The first two and the last two and a half months of the year were almost rainless, the Orissa Division alone receiving its normal amount of rain in January. On the other hand, the rainfall was nearly everywhere in excess in July, and much in excess in North Bengal during August and September; whilst Bihar suffered from a deficiency in August, and from an excess in September. The Sanitary Commissioner thinks "the "scanty rainfall during October, by failing to wash away surface impurities and flush out filthy tanks "and ditches prior to the cessation of the rains, rendered the last quarter of the year generally "unhealthy." Deficient and unseasonably distributed rainfall was unfavourable to the crops, but "the average prices of staple grains were more or less lower than in the preceding year in almost "every district."

2. A *birth-rate* of 40·14 per thousand of population is recorded for the year under review, as compared with 38·57 in the preceding year. This probably falls but little short of the true rate, and is a fresh proof of the remarkable progress which has taken place in birth registration in Bengal since 1892, prior to which it was limited to municipal towns. The Inspectors and Sub-Inspectors of Vaccination report that, of 305,986 births which they were able to verify during the year, only 2,617, or ·85 per cent., remained unrecorded in the police registers. The birth-rate recorded in towns is in marked contrast with that recorded in rural areas: whilst in the former it was only 24·95, in the latter it was 40·93 per thousand of population. In last year's *Memorandum* on the Sanitary Report for the Madras Presidency it was noted that the relation of the town to the country birth-rate there recorded was reversed, the urban being higher than the rural rate. Reasons were given for suggesting that this abnormal relation between the urban and rural birth-rates recorded in Madras might be the result of defective registration. Some estimate may be formed of the fecundity of the population of the Province of Bengal from the statement made by the Sanitary Commissioner, in paragraph 11 of his Report, to the effect that 148 rural areas returned birth-rates of upwards of 45 per thousand of population. "This," he remarks, "was fairly satisfactory and was no doubt due to the general healthiness of the year 1901." When, however, reference is made to Annual Form No. IV. of the Appendix to the Report, and it is seen that male infants died at the rate of 301·80, and female infants at the rate of 254·05 per thousand of population, this satisfaction is liable to undergo some modification, and the idea suggests itself that a lamentable waste of life results from the introduction into existence of more children than their parents have the means of rearing. Perhaps the permeation of the population with knowledge may be followed in Bengal, as in Western countries, by a decrease of the birth-rate. In Great Britain this has already fallen below 29 per thousand of population, and continues to fall. The decreasing birth-rate, as might be expected, is accompanied by a decreasing death-rate.

3. The *death-rate* for 1902 increased from 31·04 in the preceding year to 33·43. This increase, the Sanitary Commissioner says, was chiefly due to the greater unhealthiness of the year. Such was probably the case; but the increase of the birth-rate from 38·57 in the previous year to 40·14 in the year under review, cannot be dissociated from the synchronous increase of the death-rate, which it undoubtedly influenced. Fever, cholera, and small-pox were all more fatal than in 1901. The mortality in urban exceeded the mortality in rural areas in the proportion of 35·98 in the former to 33·30 in the latter. The Sanitary Commissioner writes: "It will be seen that the incidence of "cholera, dysentery, and diarrhœa, and the diseases grouped under the heading 'other diseases' was, as "usual, higher in towns than in rural areas, while fever continued to show a great preference to the "latter as its favourite abode." It might be suggested, however, that this marked difference in the incidence of these diseases may be due in great part to difference of diagnosis. It seems probable that the more intelligent inhabitants of towns would succeed better in differentiating the causes of death than the less intelligent inhabitants of rural areas. The latter would appear to lump under the head of "fever," deaths which the former attribute to plague, dysentery, and diarrhœa, respiratory diseases, and "other causes." A study of the return given in paragraph 16 of the Report seems to lend support to such an explanation of the contrast between the chief causes of mortality recorded in towns and those recorded in rural areas.

4. Of the *chief diseases*, all, with the exception of plague, were more fatal than during the preceding year. The death-rate of 1·48 per thousand of population, due to cholera in 1901, increased to 2·02 in the year under report: but the course which the disease ran appears to have differed little from that annually recorded. Outbreaks are, as usual, generally concluded to have had their origin in polluted water-supplies. This being so, the means adopted with the object of cutting short these outbreaks have naturally resolved themselves into measures for the purification of those supplies. During cholera epidemics tanks and wells that are resorted to for drinking purposes were disinfected "with permanganate of potassium. "In most cases no systematic record of result was kept, as the "disinfection has to be generally done by non-medical men; but it is generally said to be attended with beneficial results." In previous *memoranda* the need for submitting the results of the treatment of wells and tanks with permanganate of potash to exact scientific examination has been insisted on. The quotation just given from the Sanitary Report may be taken as an example of the inconclusive nature of the evidence upon which belief in the efficacy of permanganate of potash in cutting short cholera outbreaks, usually rests.

5. *Small-pox*, which has been increasing in fatality since 1899, was credited with the enormous total of 57,430 deaths during the year under report. Taking into account the large increase in the number of vaccinations which has been recorded during these years of growing small-pox prevalence,

suspicion is naturally thrown, as the Sanitary Commissioner observes, on the accuracy of the vaccination returns. "The present arrangement," he says, "by which vaccination in outlying tracts is "practically left to the unchecked supervision of the subordinate inspecting staff, is somewhat risky "and defective." Examples of wholesale falsification of vaccination returns, due to slackness of supervision, are on record in other provinces. It would not be surprising if similar results followed like causes in Bengal. Occasional falsification of vaccination registers cannot, perhaps, be entirely prevented in districts employing a large number of vaccinators scattered over a wide area; but with the exercise of ordinary vigilance, systematic falsification could not long continue undetected. In paragraph 5 of the Vaccination Report for 1902-3, it is estimated that in the province, as a whole, of the total number of children under one year of age available for vaccination, 360·51 out of every thousand were successfully vaccinated. The remaining 639·99 unprotected out of every thousand would obviously supply abundance of susceptible material for the destructive effects of small-pox. In the same paragraph it is shown that, out of every thousand infants in municipalities, taken separately, 723·15 are protected against small-pox by vaccination; in other words, the proportion was almost double that for the province as a whole. Referring to the table in paragraph 16 of the Sanitary Report, it will be seen that, whilst the death-rate from small-pox in rural areas was ·79, it was in urban areas only ·37, or somewhat less than half. The comparison is instructive, in that it shows the small-pox mortality to vary in close accordance with the greater or less proportion of infants vaccinated. In this province, vaccination is still carried on chiefly with humanized vaccine lymph. Of a total of 2,781,972 operations, close upon two millions were performed by the arm-to-arm method; and the percentage of success obtained by this method was slightly greater than that resulting from the use of calf lymph, and much greater than that resulting from the use of lanolinized lymph. The exact figures give the percentage of success in arm-to-arm vaccination to have been 98·38; when calf lymph was used, 98·13; and when lanoline lymph was used, 96·75. In the Madras Presidency, in which arm-to-arm vaccination has been discontinued, and vaccine lymph mixed with glycerine is largely used, the percentage of success following the latter was only 86·9, according to the returns of the preceding year. So far, calf-to-arm and arm-to-arm vaccination have been found to yield the highest percentage of successful cases in India.

6. If the returns of mortality from *plague* could be relied upon, it would appear that there has been a marked decrease in the number of deaths from this disease during the year under report. Whilst the number of deaths attributed to plague was 78,629 in the preceding year, this fell, in the year under report, to 32,967. But, in the words of the Sanitary Commissioner: "This decrease in the "number of deaths seems to be more apparent than real, and is evidently due to the inclusion under "head 'Fever' of numbers of deaths from the septicæmic form of plague which largely prevailed in "Bihar, and which it is very difficult to differentiate from the ordinary malarial fever." Of the three methods adopted for combating plague, disinfection, inoculation, and evacuation of infected houses, the first has failed to secure the confidence of the people, and is generally disliked by them; the second is opposed to their feelings, and has been so little practised as to have had no perceptible influence on the progress of the disease; whilst the last, evacuation of houses, has never failed, where properly carried out, to be followed by an immediate decrease in its prevalence, or by its extinction. The people are at length learning for themselves the lesson which the experience of the Himalayan villagers might have taught them sooner, that in the temporary evacuation of their towns and villages they have at their command an effectual, and, as yet, the only known effectual means of ridding themselves of plague. It is gratifying to learn that evacuation is now carried out "spontaneously and generally fairly thoroughly by the people themselves without outside "interference, which seems to render them suspicious, and hampers their movements. The benefit of "such a timely exodus is most marked, the disease dying out shortly."

7. *Fever* had, as usual, credit for having caused by far the larger proportion of the year's mortality. Under this head were recorded 69 per cent. of the total number of deaths from all causes. But it is acknowleged everywhere in India that no inconsiderable number of deaths attributed to fever are due to other causes. It has been already noted that many deaths due to plague have been registered under the head of fevers. The same might be said of many deaths really due to dysentery, diarrhœa, and respiratory diseases. In a town like Calcutta, with a large staff of trained medical practitioners, and with a comparatively educated population, it will be seen that a death-rate from fever of only 6·59 is recorded against a rate for the province, as a whole, of 23·13. On the other hand, it will be seen that the rate of mortality attributed to "other causes" in Calcutta is 10·53, or almost double that for the province as a whole. So with plague, diarrhœa, cholera, and dysentery: the recorded proportion of deaths attributed to them in Calcutta is, in the case of each, higher than the provincial rate. In other words, the more correct differentiation of the causes of death in Calcutta seems to indicate that, in the rest of the province, a large proportion of the deaths due to other diseases is credited to fever.

8. Estimated by the amount expended upon them, the *sanitary works* carried out in the province during the year would not appear to have been very extensive. On *drainage*, the combined expenditure of all the municipalities was less than two lakhs of rupees; and on *water-supply* less than two and a half lakhs. Quoting from the Government Resolution on the Sanitary Commissioner's Report:—"The Sanitary Board had under consideration during the year a number of schemes for the "improvement of the water-supply, the drainage and the conservancy of various localities, but the work "actually carried out was not of importance." The two chief sanitary wants of the province are well known to be an efficient system of drainage, and the provision of pure drinking water supplies. Without these, little permanent impression is likely to be made on the enormous annual bills of mortality from fever, cholera, and bowel complaints. But judging from the progress made in the past, and taking into account the physical difficulties of the country, its extent, and its 74 millions of inhabitants, mostly poor, the execution of these undertakings is likely to be a work of time, and of a long time.

21st July, 1904.

No. 3.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of the United Provinces of Agra and Oudh for the year 1902.

The meteorological conditions of the year did not show any very marked deviations from normal. The rains broke in the first week of July and continued to fall during the following two months of August and September with more or less of regularity. They were in defect in most parts of the province during October; and, except for the fall on the 1st of November, the rest of the year was rainless. Judged by the birth and death rates recorded, the public health was good. Excepting plague, none of the other chief diseases prevailed during the year with unusual severity.

2. The *birth-rate*, which, under pressure of famine, had fallen in 1897 to 31·10, has again risen and at length reached, under the influence of more prosperous conditions, 45·84 during the year under review. It exceeded the death-rate by no less than 13·30 per thousand of population. The proportion of male to female births was 107·25 of the former to every 100 of the latter, and may be accepted as approximately the normal proportion for the province.

3. The *death-rate* of 32·54 was higher than in the previous year, when it was 30·30; and was nearly the same as the quinquennial mean of 32·48. The increase, it will be observed, accompanied the increase in the birth-rate from 41·35 in the previous year to 45·84 in the year under report. It is evident that, whilst infants die at the rate of 243·6 per thousand as compared with a death-rate at all ages of only 32·54, the general provincial death-rate will rise with the rise in the proportion of infants in the population. The high and increasing infantile mortality in these provinces has attracted the attention of the Lieutenant-Governor, who expresses a wish that the Sanitary Commissioner will give the subject his future attention. The following quotation sufficiently indicates that Colonel Thompson clearly realises one, and probably the chief, cause of the high infant mortality recorded in the United Provinces, and, for that matter, in other Indian Provinces: "Excluding the famine period, the high mortality of late years has coincided with high birth-rates. "The infantile death-rate in a European population is usually considered to form a delicate index to "the sanitary conditions under which a community is living, but in a country in which children are "hurried into the world with very little consideration as to how they are to be maintained, it loses "a good deal of such significance." In plain terms, Indian parents produce more children than they have the means of rearing, and hence one of the chief causes of the lamentably high death-rate recorded amongst infants. In several municipal towns the infantile death-rate exceeded 400 per thousand births.

3. As usual, the Report contains a return of deaths the causes of which have been verified by medical officers, medical subordinates, and medical practitioners. Of 10,018 deaths, the causes of which were thus verified, nearly equal numbers were due to *malarial fevers*, to *diarrhœa and dysentery*, and to *respiratory diseases*. Under the head of the first of these there were registered 1,587, of the second 1,565, and of the third 1,586. Comparing these figures with those recorded in the general provincial returns, which are prepared mostly from the reports of the village watchmen, it will be seen that in the latter, instead of each of these three causes contributing nearly an equal number of deaths, fever is credited with a death-rate of 24·51 per thousand of population, dysentery and diarrhœa, together, with ·58; and respiratory diseases, now for the first time separately registered, with only ·33. There is little that is new in this comparison; but its repetition from time to time may be useful in keeping attention fixed on the need for improving the registration of deaths according to their causes. The results of the testing of vital statistics by local authorities and by the vaccination staff, show that, as regards their numbers, deaths are recorded with remarkable accuracy. The omissions detected by the former of these inspecting agencies amounted to 1·7 per cent., and by the latter to only ·29. Considerably over a quarter of a million entries were tested by the local authorities, and somewhat less than a quarter of a million by the vaccination staff.

4. Of the *chief diseases*, none prevailed with unusual severity, excepting *plague*. *Cholera* had attributed to it a death-rate of only ·53 per thousand of population, small-pox of ·10, and fever of 24·51. The mortality from *dysentery* and *diarrhœa* was practically the same as in the preceding year. The mortality attributed to "all other causes" increased from 4·59 to 5·16. "It may be "conjectured that a certain number of cases of plague were still entered under the head of 'all other "'causes.'" Deaths from plague have now, for the first time in these provinces, been recorded in a separate column. The existence of the disease was notified in 34 out of the 48 districts of the province; but in 14 of these the number of cases was very small, and in several was confined to a case in each. The disease has, however, shown an alarming increase within the year. Whilst only 9,778 deaths were attributed to it in 1901, this number has increased during the year under review to 40,223. Females died from it in considerably greater numbers than males. This difference of liability to death from plague, the Sanitary Commissioner thinks "may very possibly be due to the "facts that Native females spend more time inside their houses and court-yards than do men, and, "moreover, do not so habitually wear shoes."

5. Under the head of *Sanitary Works*, a brief statement is given of the amount of water consumed per head by the inhabitants of the eight municipalities provided with water-works. During the year, the quality of the water supplied to these municipalities was, almost without exception, of a high standard of purity. "Many sanitary improvements in various directions have "been effected in municipalities and smaller centres of population during the past year. The "prevalence of plague has drawn increased attention to the necessity for such measures. The "sanitary feature of the year, doubtless, is the great advance made towards efficiently draining "the site and removing the sullage water from the inhabited area in the larger centres of "population."

21st July, 1904.

No. 4.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of the Punjab for 1902.

Neither in its meteorological features, nor in its prevailing prices of food and rates of wages, was the year unfavourable to the public health. The first two months of the twelve were exceptionally dry. The monsoon set in on the 20th of June and withdrew from Upper India about the 22nd of September. The rainfall during this period was in general defect and, as a consequence, the temperature was high. The last two months of the year were bright and dry, with a comparatively high temperature until the middle of December. The normal rates of food, with which the previous year of abundance closed, were maintained throughout 1902. There was no material variation in wages, except in Delhi, where the great demand for skilled labour during the Durbar caused them to rise, and in the districts of Jhang and Muzaffargarh, where they were lower than in the previous year. Under such conditions a low death-rate might have been expected; and this would doubtless have been recorded, but for a remarkable and fatal extension of the plague epidemic, which, of itself, was the cause of no fewer than 171,302 deaths, equal to about one-fifth of the total mortality from all causes in the province.

2. The *birth-rate* of 43·8 per thousand of population exceeded that of the previous year by 8·4; and was exceeded only by the rates recorded in the United Provinces of Agra and Oudh, and in the Central Provinces. As a striking proof of the accuracy to which the registration of births and deaths has at length attained in the Punjab, the Sanitary Commissioner refers to the last Census Report, from which, he says, it will be seen that there was a difference of only 22,399 between the population of the Punjab according to the census of 1901 and the vital statistical estimate, a figure which, in the opinion of the Census Superintendent, is "really wonderfully small in a population of "over twenty million souls." Notwithstanding the high birth-rate for the year under report, it was exceeded by the death-rate. An examination of the returns shows that this result was due to the enormous mortality in the districts which suffered most from plague. In Ludhiána the mortality exceeded the births at the rate of 67·2 per thousand, in Umballa the rate of excess was 29·2 per thousand, and in Jullundur and Siálkot 14·7 and 12·3 per thousand. This loss of population was made good by the very substantial increase of births over deaths in the Ráwalpindi and Mooltan Divisions.

3. The *death-rate* of 41·1, recorded in the Punjab during the year, was higher than that recorded in any other Indian Province. The increase of 8 per thousand of population over the death-rate of the preceding year was due almost entirely to plague. March and April, ordinarily the healthiest months of the year, were months of high plague mortality and returned the highest death-rates of the twelve. The death-rate amongst infants, calculated on the number living, was 316·44 per thousand for male children, and 320·76 for female children; but calculated on the number of births registered during the year under report, it was only 233·43 and 241·84 for male and female children, respectively.

4. Of the *chief diseases*, *cholera* was, again, for the second successive year, in abeyance, only 371 deaths from it having been registered, following 180 in the preceding year. A local outbreak occurred in a small village in the Kangra Valley and was the cause of 65 seizures and 38 deaths. The history of the outbreak is given in some detail in paragraph 23 of the Sanitary Report. "The Military "Assistant Surgeon, in charge of the Palampur Dispensary, who inquired into the particulars of the "outbreak at the time of its occurrence, found that the origin of the disease was due to the "contamination of the drinking water of one of the village tanks by the washing of the soiled linen of "a sepoy who had returned to the village on the 2nd December from Burma, suffering from diarrhœa "on his way up." The Civil Surgeon of the Kangra District repeats the Assistant Surgeon's statement that the infection was brought to the village by a sepoy returning from Burma, whose clothes were washed by his wife in the tank from which one half of the village procure their drinking water. The half of the village using water from the polluted tank suffered from cholera; whilst the other half supplied from another source escaped. The evidence in support of the pollution of the drinking water and of the diffusion of cholera in consequence of this pollution, has the appearance, at first sight, of being complete. But there are one or two links in the chain which are missing. In the first place, it is not stated that the sepoy was suffering, or had been suffering, from cholera. His complaint is described as "diarrhœa"; and if it was diarrhœa, and nothing else, it is not clear why it should have been the cause of an outbreak of cholera. The circumstance of Burma having been the country from which the man came, would not strengthen the case, unless it were shown that cholera was prevalent in the particular part of that province in which he had been. Even then, had he become infected with cholera in Burma, it might be expected that he would have developed the disease and either have died or recovered from it long before he could reach the Kangra Valley. Moreover, although it is stated that the sepoy reached the village on the 2nd December, the date on which the first case of cholera resulting from drinking the water polluted by his clothes having been washed in it, is not given. The report concludes:—"The inhabitants ceased to use the infected water, "and the tank was disinfected by the permanganate of potassium—the cases ceased immediately." If, as this account seems to imply, the tank was disinfected by permanganate of potassium after the villagers had discontinued using water from it, the influence which such disinfection could have exercised in cutting short the epidemic is not apparent. This isolated outbreak was one which would seem to have afforded facilities for tracing the disease to its source; but the evidence adduced in support of the conclusion that the sepoy from Burma introduced the infection is incomplete.

5. *Small-pox* was nearly twice as fatal as in the preceding year, accounting for 11,629 deaths, or a ratio of 0·58 per thousand of population, as compared with 0·31 in the previous year, and with a mean ratio of 0·36 for the preceding five years. The number of deaths due to it amongst infants under one

year of age was 26 per cent. of the total small-pox deaths in the Province. In towns the disease was nearly twice as fatal as in rural areas. A list of towns is given, with small-pox death-rates rising from 5·12 to 11·83 per thousand of population. In none of these towns was vaccination compulsory. On the other hand, of the 22 towns in which vaccination is compulsory, in not one did the small-pox death-rate exceed 1·6 per thousand; and in four of them not a single death from the disease was recorded. The number of vaccine operations recorded during 1902–3 fell but little short of the number recorded during the previous year, in spite of the work of the department having been much impeded in some parts of the Province by the prevalence of plague. The Sanitary Commissioner, in his Notes on Vaccination, puts on record that the Deputy Sanitary Commissioner "was employed "under the orders of Government on special duty—testing plague prophylactic bacteriologically—from "9th December, 1902, to 7th March, 1903, that is, during the most important part of the cold weather "vaccination season, and was accordingly unable to give much attention to the superintendence of "vaccination work." It has repeatedly been demonstrated that, without unremitting vigilance on the part of the European Staff of the Department, the system of vaccination practised in India cannot be satisfactorily carried out. Only too many instances are on record of the disastrous effects resulting from insufficient supervision: sometimes the returns are falsified; frequently operations which have failed are returned as having been successful, and the faith of the people in the protective power of vaccination is, in consequence, shaken and not readily restored.

6. But for the fatal epidemic of *plague*, which was accountable for a large proportion of the total mortality, the history of the public health of the Province during the year under report would have been comparatively uneventful. The ravages of this disease, in its most destructive form, were fortunately confined to a few districts. In seven of these, 90 per cent. of the plague mortality occurred. The district of Ludhiana was the greatest sufferer, losing, as it did, from plague alone, 71 out of every thousand of its population. The epidemic followed its usual course, "increasing rapidly "in the winter months, reaching its climax in the spring, and declining suddenly with the commence-"ment of the hot weather, and disappearing almost entirely in the months of July, August, and "September." It is stated by the Civil Surgeon of Ludhiana "that rats, as a rule, were found dying in "every village before the commencement of outbreaks of the disease among the inhabitants, and that "those villagers who went out at the discovery of rats dying and did not visit their houses, mostly "escaped." This is but a repetition of the history of local outbreaks in Himalayan villages, many years before the commencement of the present epidemic in Bombay City, towards the end of 1896. Immediate evacuation of infected dwelling-houses, the remedy hitherto found to be most effectual in extinguishing plague outbreaks in the hills, is shewn by the experience of the past seven years to be the most efficient means yet discovered for extinguishing them in the plains.

7. As regards *fever* prevalence, the year may be described as having been fairly normal. The death-rate attributed to this cause was 23·54 per thousand of population, or nearly the same as the mean ratio for the previous quinquennium.

8. The death-rate recorded under the head of *dysentery and diarrhœa* is probably far from representing the actual rate due to these causes. In our *Memorandum* on the Sanitary Report for the United Provinces, reasons based on the returns of deaths, according to their causes, furnished by medical men, have been given for the belief that, whilst the number of deaths attributed in the returns to fever is exaggerated, the number attributed to dysentery, diarrhœa and to respiratory diseases is greatly understated.

9. The report submitted by the Sanitary Board and the Sanitary Engineer to Government, testify to considerable activity in the endeavour to improve the water-supply and drainage of towns and villages. The need for such improvements is fully recognized; but their execution is retarded by the lack of a sufficiency of funds.

21st July, 1904.

No. 5.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Administration of the North-West Frontier Province for the year 1902.

The year was a very dry one. The rainfall of 3·9 inches was the lowest recorded in Peshawar for the last 26 years. As a consequence of this exceptional dryness, it might have been expected that the year would have been more than usually exempt from fever. Such was not, however, the case, the fever death-rate having been 18·92 per thousand of population, or 4·30 higher than the rate for 1901, and 2·19 higher than the mean ratio for the previous five years. Except in one of the five districts of the Province, the price of food grains, and the rates of wages remained nearly the same as in the preceding year, and the people did not appear to have suffered from scarcity of food. In the district of Bannu the rainfall was scanty and food prices were high, but there was very little consequent distress, and the Civil Surgeon did not notice any ill-effects on the health of the inhabitants to follow.

2. The *birth-rate* rose to 33·6 per thousand of population, showing an increase of 3·3 over that of the preceding year and of 2·9 over the mean rate of the preceding five years. In this increase it is probable that improved registration of vital statistics had a share. As an indication of the improvement being effected in registration, the tendency of the proportion of male to female births to approximate, may be noted. In the previous year, 123·2 births of males were registered for every

100 births of females; in the year under report the proportion was 121·9 of the former to 100 of the latter. The disproportion is still abnormal, but may be expected to diminish as registration becomes more accurate.

3. The *death-rate* increased from 19·7 in the previous year to 24·4 in the year under report, and was higher than the mean for the previous five years. The mortality record would not, therefore, support the Administrative Medical Officer's opinion that the year "may be considered a healthy "one" It is true that there was an entire absence of cholera, and that only a few imported cases of plague were reported; but, on the other hand, fever prevailed in epidemic form in some districts, accounting, by itself alone, for a death-rate of 26·96 per thousand of population in the district of Kohat. A comparison of its mortality records with those for other provinces would lead to the conclusion that, as the Administrative Medical Officer remarks, the North-West Frontier Province is the healthiest, next to Madras, in India. The comparison might rather suggest, however, that registration of vital statistics is more defective in this than in any other of the Indian provinces, with the exception of Madras. The testing of the entries in the birth and death registers during the year by the inspectors of vaccination shows that a large proportion of the births and deaths remained unrecorded. Of 17,459 births verified, no fewer than 2,358 were discovered to have escaped registration; and of 13,354 deaths no fewer than 1,451. The testing of the registers by vaccinators would, by comparison with the foregoing figures, appear to be wanting in thoroughness. Of 25,913 births, said to have been verified by them, only 566 were found to have been omitted; and of 17,379 deaths only 219. The contrast between the results obtained by these two inspecting agencies seems to suggest excess of zeal on the part of one of them, or want of it on the part of the other. As a consequence of the persistent scrutiny to which the registers of births and deaths are subjected in the province, "a distinct improvement" in registration is said to be perceptible.

4. *Chief diseases.*—From *cholera* the province was entirely free; and although four deaths were caused by *plague*, none of the four occurred amongst the indigenous population; the cases were all of them imported from the Punjab. *Small-pox* was, however, more fatal than in the previous year. and to this cause were ascribed 1,081 deaths, equal to a ratio of 0·54 per thousand of population, Vaccination made satisfactory progress, the number of operations exceeding that of the previous year by 19,300, or 27·19 per cent. This increase was accomplished without any addition to the vaccination staff, which remained of the same strength as in the preceding year. A satisfactory feature of the season's work is the high proportion of infants vaccinated. These constituted no fewer than 43,951 of the total number of 77,030 successful primary vaccinations. By far the larger proportion of deaths from all causes was registered under the head of *fever*. To this cause was ascribed a death-rate, per thousand of population, of 18·92, the total from all causes having been 24·43 for the province. In the district of Kohat fever was especially fatal, accounting, according to the returns, for no less than 26·96 deaths per thousand of population.

5. Although no *sanitary works* of magnitude were executed during the year, important improvements in the water supply and drainage of towns were carried out. In the Dera Ismail Khan district, "all the water tanks are reported to have been cleaned, as well as all the wells in the town "from which drinking-water was obtained." In no direction could the limited amount of funds available for sanitary purposes have been expended to greater advantage. It is disappointing to read that "no rewards were paid or *khillats* given during the year to village communities for special "interest taken in sanitary improvement." The Administrative Medical Officer adds, that the issue of village sanitary note-books does not appear to have been attended with any success.

21st July, 1904.

No. 6.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Burma for 1902.

The year was a healthy one. The rainfall, both in Lower and in Upper Burma, was considerably less than the amount recorded for the previous year, and also than the mean for the five-year period 1896–1900.

2. The registration of vital statistics continues still to be limited almost entirely to Lower Burma, with its population of somewhat over five and a half millions. In Upper Burma, births and deaths are recorded only in thirteen towns, with an aggregate population of 300,969. In Annual Form No. II. of the Appendix to the Sanitary Report, the population numbers for the districts of Upper Burma are not shown.

3. The *birth-rate* recorded in Lower Burma for the year under review shows a decrease of ·5 per thousand of population, as compared with that for the previous year. There can be no doubt that the recorded birth-rate of 31·57 is much below the real birth-rate. Whilst the census figures of 1901 showed that during the preceding ten years the population of Burma had increased by 24 per cent., the increase calculated by adding the excess of births over deaths for the same period was only 14 per cent. Leaving out of count the additions to the population resulting from immigration

during this period, these figures would indicate that a very large proportion of the births remained unregistered. In paragraph 3 of the Report, the Sanitary Commissioner states that, of the 17,111 villages and towns under registration in Lower Burma "the registers of 48·2 per cent. were inspected "during the year under report." What such "inspection" implies is not explained; but it is pretty safe to assume that a house-to-house inspection was not made in 48·2 per cent. of these 17,111 villages with the object of ascertaining if all of the births and deaths which actually occurred in them were recorded in these registers. To carry out such an inspection would imply the expenditure of more time and labour than civil surgeons, vaccinators, and district officials would have at their disposal for such a duty. And yet, to determine whether the entries in the village registers accurately correspond with the births and deaths which have occurred in the villages, only such a house-to-house inspection can be relied upon. Instead of attempting the inspection of so large a proportion of the registers—an inspection which cannot well be thorough—it might be found to be more effectual in improving registration if the accuracy of a smaller number were tested by a careful house-to-house inspection in certain selected towns and villages.

4. The *death-rate* of only 21·16 recorded for the year is, like the birth-rate, abnormally low: and this is doubtless mainly due to defective registration. In the towns of Lower Burma, in which registration is probably better effected than in the country, the death-rate was 29·93 per thousand of population; whilst in rural areas the rate was only 19·97. The rates of deaths amongst children under one year of age per 1,000 living was, for males, 307·47, and for females, 221·89; but calculated on the number of births recorded for the year under report, it was only 217·57 for the former and 173·17 for the latter. With registration still so imperfect no great reliance can be placed on those figures.

5. Under the head of each of the *chief diseases*, except fever, fewer deaths were recorded than in the previous year. Neither Upper nor Lower Burma suffered much from *cholera*; in the former, 1,344 deaths were attributed to this disease, and in the latter only 57.

6. *Small-pox* was credited with only 1,565 deaths or less than half the mean number for the five years 1897–1901. The death-rate per thousand of population from this disease only amounted to ·28. Although the combined returns for Lower and Upper Burma show an increase in the number of persons vaccinated of 17,534 as compared with the number for the preceding year, the whole of this increase took place in Upper Burma. The returns for Lower Burma show a decrease, which the Sanitary Commissioner attributes to the attitude of the people, many of whom prefer inoculation to vaccination. A closer supervision of the work of vaccinators, and the punishment inflicted for falsifying returns are also assigned as contributory causes of the decrease. The class of men who take service in the Vaccination Department in Burma is said to be indifferent. The last of these three causes, the inferior stamp of candidate for employment as a vaccinator, is, perhaps, the most important. Better pay would doubtless attract better men. Whilst the people are still so unfavourably disposed towards vaccination, it is unlikely that vaccinators receive much beyond their pay for their services. The lot of the vaccinator in a country of which the inhabitants are hostile to vaccination is not an enviable one. The percentage of successful cases in primary vaccination was as low as 87·14 as compared with 90·27 in the preceding year. This falling-off is probably due to the closer supervision to which the work of the vaccinators is now subjected. It may also indicate deficient knowledge and skill on the part of the operators. "The quality of the lymph was "on the whole satisfactory." For its supply 386 calves were inoculated.

7. The death-rate ascribed to *fever* in Lower Burma was 8·86 per thousand of population as compared with a mean of 10·93 for the previous five years. If these figures can be relied on, the mortality from fever in Burma is less than in any other province of the Indian Empire, except Madras. But both in Burma and Madras, the former of which returns a death-rate from all causes of 21·6 and the latter of 20·2, defective registration, rather than greater healthiness, would probably account for the lowness of the death-rate as compared with that recorded in other provinces.

8. Regarding *plague*, quoting from the Government Resolution on the Sanitary Report, "the "stringent measures enforced against the introduction of plague have again been attended with "success." Three imported cases were detected in the port of Rangoon at the medical inspection imposed against all vessels arriving from India.

9. *Sanitary Works* made some progress in the chief towns. The successful sinking of tube wells in Rangoon has made it possible for that city to discontinue the use of water from the Royal Lake, which had repeatedly been condemned as unfit for drinking purposes; whilst the "Hlawga" water-supply scheme, estimated to cost 39 lakhs of rupees, has been more than half completed. In Upper Burma the water-supply and conservancy schemes make but little progress. According to the Government Resolution:—"The water-supply scheme is advocated mainly on behalf of the "troops and other inhabitants of cantonments, and progress cannot be made owing to delay in "working out the cantonment part of the project." The scheme for providing Moulmein with a water-supply is already well advanced toward completion; whilst that for Akyab has been submitted to the Sanitary Board for approval. The water-supply of Prome is being extended and improved; whilst the surface drainage of the town is said to be making steady progress. Judging from the small sum of less than two lakhs of rupees expended on district sanitation, it may be concluded that only sanitary works of a minor description were undertaken during the year.

21st July, 1904.

No. 7.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of the Central Provinces for 1902.

This Report has already been dealt with so thoroughly in the Government review attached to it that further comment seems scarcely to be called for. It is true that the section on meteorology is, in accordance with the Government of India, omitted from provincial Sanitary Reports; but nevertheless, without going into details, it would be useful to have a paragraph given to an account of the general climatic features of the year and of the harvests, together with some estimate of the influence which these may appear to have had on the public health. Nothing is said of the character of the season, beyond the remark incidentally made in connection with the subject of fever prevalence, that "it was a dry year."

2. Judged by its record of births and deaths, the year was a very healthy one. The birth-rate was unusually high, having risen to a ratio of 48·29 per thousand of population, as compared with 28·83 in the previous year, and with a mean of 45·16 for the decennium. It might have been expected that so large an increase in the birth-rate would have been accompanied by a corresponding increase in the death-rate; but the latter only rose from a ratio of 23·46, in the previous year, to a ratio of 25·82 in the year under report. The fall in the infantile death-rate from 246·41 in the previous year to 228·10 in the case of male children, and from 224·63 to 206 in the case of female children, may be accepted as reliable evidence of the greater healthiness of the year under report.

3. Considerable space is devoted to an account of the measures taken to bring to light defects in the registration of vital statistics. Some misapprehension seems still to exist on this question, although an endeavour was made in our *memorandum* on the Sanitary Report of the Central Provinces for 1900 to make it clear that a comparison of the entries of births and deaths in the village watchmen's handbooks with those made in the registers kept at the police stations would fail to supply evidence of the omission to report births and deaths. The figures given in paragraph 25 of the Report show that the numbers of births reported by the *kotwars*, or village watchmen, differ but slightly from the numbers registered by the Police, the former being 63,398 and the latter 63,361; in other words that the clerks at the Police stations transcribed with tolerable accuracy into their registers the entries of births and deaths found in the *kotwars*' handbooks. The *kotwars*' books and the Police registers might be in exact agreement, and yet hundreds of births and deaths may have escaped, and probably did escape, record by the *kotwars*. In the table given in paragraph 26 it will be seen that Police officers in checking, doubtless by house-to-house inquiry, 150,719 entries in the *kotwars*' books, discovered 1,735 omissions; and that Civil Surgeons in testing 21,031 entries similarly discovered 344 omissions. These figures are in marked contrast with those shown in the preceding paragraph, where the number of births reported by the *kotwars*, registered by the Police, and verified by Native Superintendents are in close agreement, the *kotwars* recording 63,399, the Police 63,361, and the Native Superintendents 63,324. Of these three sets of numbers it is safe to assume that the first set is more likely to be correct than the last two: *kotwars* frequently omit to report the occurrence of births and deaths; but it is believed they rarely, if ever, venture to enter births and deaths which have not occurred.

4. Of the *chief diseases*, *cholera* was practically absent from the Province, only 28 deaths having been ascribed to it during the year. *Small-pox*, although less fatal than in the previous year, still accounted for 4,394 deaths. Vaccination appears, from the returns, to have made satisfactory progress, primary operations having increased by 69,869 as compared with the previous year's numbers. In re-vaccination there was, on the other hand, a decrease of 9,019 operations. One of the most favourable features of the year's work was the high proportion of children under one year of age who were successfully vaccinated. In the Province, as a whole, 79·37 of the infant population available were successfully vaccinated; in one district the ratio was 92·70. The percentage of successful cases recorded in primary vaccination was 97·13, and in re-vaccination 85·14. The latter figures are high; and the Administrative Medical Officer observes that "it is difficult to understand "the very successful results of re-vaccination recorded in some districts." Fresh calf-lymph and humanized vaccine lymph yielded almost the same percentage of successful cases, and both gave better results than glycerinated calf-lymph. The number of calves, 10,334, required for the supply of lymph seems very large. According to the table given in paragraph 15 of the Vaccination Report, 337,823 operations were performed with calf-lymph. Each of the calves successfully inoculated would, consequently, have afforded lymph for the vaccination of rather less than 35 persons.

5. The deaths attributed to *plague* numbered 1,061; but the Administrative Medical Officer gives good reasons for the belief that this number is far short of representing all the deaths actually caused by this disease. The difficulties with which the authorities have still to contend in their endeavours to prevent the ingress of plague into a town, or to stamp it out when it has secured a footing, are well exemplified in the case of Burhanpur:—"The attitude of the people was from the " first unsatisfactory. They would not have it that there was plague in the town; they concealed the " cases; they resented everything that was doneto check the spread of the disease, and only asked to " be let alone. The result was a virulent and widespread epidemic, which has only quite recently " come to an end after inflicting enormous damage on the town."

6. Following upon recent discoveries regarding the causation of malarial fevers, the question of the prevention of these diseases has received special attention in the Central Provinces. Systematic operations for the destruction of malaria-carrying mosquitoes have been recommended by the Administrative Medical Officer, and approved of by the Government, in certain selected municipalities. In so far as these operations include the filling up of hollows in which water lodges, and the

drainage of town sites, only benefit to the public health can result; but, to quote from the Report of the anti-malarial operations at Mian-Mir 1901-03 :—"The destruction of *anopheles* within an area by "attacking their breeding-places is extremely difficult. Although large numbers of pools were filled "up and drained, and millions of larvæ destroyed by oil, adult *anopheles* were still abundant The "mere obliteration of local breeding-places is useless. In Mian-Mir almost complete absence of "breeding was ensured to a distance of over half a mile, but adults appeared in large and increasing "numbers in the area." The Report concludes: "Moreover, it appears to us that gradual but "permanent improvement in the health of stations by well-directed sanitary reforms, whenever these "can be carried out, will in the end yield the best return." A writer in the British Medical Journal says it is almost the universal opinion in India that "destruction of *anopheles* as a method of malarial "prophylaxis is a hopeless measure in that county, even in unusually favourable conditions, while in cases such as Lower Bengal it would be sheer folly and waste of money to attempt it." A measure, regarding the beneficial effects of which in the campaign against malarial fevers there can be no room for doubt, is the distribution throughout the Province of quinine. Every facility is provided by the Administration for the purchase of the drug; and the growing demand for it affords evidence of the appreciation by the people of its usefulness.

7. The paucity of important *sanitary works* executed during the year was due to lack of funds and not to the absence of urgent need for such works. "Under the head of rural sanitation most of "the work consisted of clearing village sites and maintaining village sanitation in the ordinary way." Sanitary work of this nature is probably as much as the resources of the villages will admit of being carried out; it is none the less useful because of a simple and unpretending character.

21st July, 1904.

No. 8.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner for Assam for 1902.

The Sanitary Commissioner gives a concise account of the meteorological conditions of the year under report. The province consists mainly of two distinct parts, the Brahmaputra and the Surma Valleys, of each of which the climatic features differ widely. In the Brahmaputra Valley, the rainfall is usually 20 or 30 inches less than in the Surma Valley. The temperature and other climatic conditions of the latter are practically the same as those of Lower Bengal. The upper and lower parts of the Brahmaputra Valley record nearly the same rainfall, but the temperature of the former is lower than that of the latter, whilst both are cooler than the Surma Valley. During the year under report it is stated that, in the Surma Valley, the rainfall was abundant, although not excessive; and that no unusual climatic phenomenon was observed. Likewise, in the Brahmaputra Valley, the year presented no abnormalities and corresponded closely with the average of the three preceding years. So far as the Sanitary Commissioner can judge, the variations in the prices of the food grains in Assam have little, if anything, to do with the birth-rate. In this view, the Government concurs. "Mr. Bolton accepts the opinion that the prices of food grains have no influence on the birth and "death rates in Assam." The people are described as being well-off; food is plentiful everywhere, and life taken so easily that only a minimum of work is done anywhere. Famines are unknown. Into such a country it might be expected that immigrants would pour voluntarily from the congested districts of Bengal and the United Provinces, where the conditions of life are, at the best of times, the reverse of those described as prevailing in Assam.

2. The health of the province during the year under report is said to have been "extremely "good." The *birth-rate* recorded was 34·21 and the *death-rate* 29·01 per thousand of population. There can be no doubt that both are much below the actual rates, owing to the defective state of registration still prevailing in most of the districts of the province. Accepting them as recorded, the birth-rate exceeded the death-rate by 5·20 per thousand. The weakest part of the system of registration of vital statistics in Assam is the employment of unpaid *gaonburas*, or village headmen, in five of the eight districts of which the province consists, for the record of births and deaths. In the remaining three districts registration is effected by paid village watchmen and is comparatively well done. With a view to giving the unpaid village headman an interest in the better performance of his registration duties, "the Administration has submitted a proposal to make a revenue-free grant "of $3\frac{3}{4}$ acres of land to each *gaonbura*, at an estimated cost of Rs. 40,000 per annum." Meantime, energetic measures are employed to obtain from both classes of agencies, paid and unpaid, more accurate returns. As a result of the inspection of registration during the year by members of the Police and Vaccination Departments, no less than 31·5 per cent. of all the births and 29 per cent. of all the deaths in the province were subjected to inquiry. Of the former, 5·8 per cent. were found to be unrecorded, and 5·3 per cent. of the latter.

3. But for its severe epidemic prevalence in a single district, *cholera* was in comparative abeyance throughout the province during the year. Of a total of 12,658 deaths from this disease, no fewer than 8,804 occurred in Sylhet alone, a district in which cholera is endemic. Although, as a result of this outbreak, the mortality due to cholera exceeded that of the preceding year, it was still much less than the average for the 16 years 1884–99. The death-rate from cholera among tea-garden coolies, whilst in transit from Goalundo to the port nearest to the place of their employment, was 0·9; and was only once lower during the fifteen years for which records are available in the Sanitary

Commissioner's office. This fall in the rate of mortality amongst these coolies shows, the Sanitary Commissioner thinks, that greater precautions are taken on the steamers, and greater care taken not to ship infected coolies. "The garden rates were everywhere higher than the general ones, except in the Sylhet district, where the mortality was four times as high as in last year." This higher death-rate from cholera in tea gardens, if actual and not merely apparent, is remarkable in view of the better sanitary conditions under which the tea-garden coolies are compelled to live; and suggests that it may be due to the greater accuracy with which deaths from cholera, as from all other causes, would presumably be recorded on tea gardens than amongst the general population.

4. *Small-pox* prevailed in severe epidemic form in the two districts of the Surma Valley. Of the total number of 6,673 deaths recorded from this disease, all except 304 took place in these two districts. The Sanitary Commissioner attributes the epidemic to the dissemination of small-pox contagion by inoculators, and thinks that the operation of inoculation could, and should, be made illegal, and the Ganaks performing it made punishable by law. The returns of vaccination deal with the entire population of the Province of Assam, numbering 6,126,343; whereas the returns relating to vital statistics do not deal with those portions of the province in which births and deaths are not recorded, such as the hill tracts and the State of Manipur, and relate only to a population of 5,275,706. If the state of protection against small-pox conferred on the population by vaccination might be estimated by the ratio per thousand vaccinated, deaths from small-pox in Assam should be few in number. According to Statement I. in the Appendix to the Report on Vaccination for 1902–03, the ratio of persons successfully vaccinated per thousand of population during the year was 48·18, or much in excess of the provincial birth-rate. But this ratio varies greatly in the different districts; in Cachar it was only 16·72, the lowest recorded; and in this district the small-pox death-rate, 2·71, was the highest. As an indication of the slight influence which vaccination is likely to exercise on the prevalence of small-pox in this district, it may be noted that, whilst the births registered during the 12 months of the calendar year 1902 numbered 14,759, the children under one year of age successfully vaccinated numbered only 1,247 during the 12 months of the vaccination year 1902–03. The quality of the vaccine lymph is said to have been generally excellent throughout the year; and this is confirmed by the high percentage of 97·90 successful cases recorded in primary vaccination. But when, as in the case of the returns for the Khasia and Jaintai Hills, one finds cent. per cent. of 4,241 primary vaccinations recorded as "successful"; and still more remarkable, cent. per cent. of 143 re-vaccinations also recorded as "successful," doubts are apt to arise as to the trustworthiness of the returns.

5. The mortality from *malarial fevers* shows a considerable decrease as compared with that recorded in the preceding year; whilst the number of deaths ascribed to *kálá ázár* is almost the same as in 1901. It might be concluded from the returns that the invasion of Sylhet by this disease was sudden; but the Sanitary Commissioner writes: "I saw many cases myself, both in 1899 and in 1900, which I have no doubt in the world were genuine *kálá ázár*, but it was not until an officer was deputed on special duty to visit each village in turn that the extent of prevalence of this dreaded disease was known."

6. An interesting inquiry is being made into the cause of the greater mortality from *dysentery* and *diarrhœa* amongst tea-garden coolies than amongst the general population of the province; but no definite conclusion on the question has yet been reached. The Civil Surgeon of Lakhimpur finds that, whilst the tea-garden coolies suffer about three times as much as the other classes of the people from bowel complaints, they ail about three times less from fevers; the result being that the combined mortality due to fever and bowel complaints is about the same in the case of both. This would seem to suggest that the difference may be due rather to difference of diagnosis than to greater fatality from bowel complaints among the tea-garden coolies; some of the deaths registered as due to fever among the general provincial population being more correctly attributed to dysentery or diarrhœa in the case of the tea-garden population. It may, however, be noted with regard to the tea-garden coolies, as it has been noted by some medical officers with regard to prisoners in Indian jails, that the change from the scanty dietary on which they probably subsisted at their homes prior to their recruitment to a fuller dietary whilst employed in the tea-garden may have tended to induce derangement of the alimentery tract and diarrhœa or dysentery.

7. According to the Government Resolution on the Report, no *sanitary work* of any magnitude was undertaken during the year; but useful work was done by Local Boards in improving the water supply.

21st July, 1904.

No. 9.

Memorandum by the Army Sanitary Commission on the Rajputana Sanitary, Vaccination, Dispensary, and Jail Report for 1902.

As noted in previous *memoranda*, and is still the case, the only portion of Rajputana which records vital statistics having any claim to accuracy is Ajmer-Merwara with its population of less than half a million. In the greater part of the Province, consisting of Native States with a population of close on ten millions, the returns of births and deaths are so inaccurate as to possess little or no value beyond showing the need for improving them.

2. The year under report was marked by scarcity and famine in Ajmer-Merwara and in some of the Native States. The rainfall was tess than the average and the prices of food were high ; but in spite of these unfavourable conditions the year was a healthy one. Whilst the number of deaths remained nearly the same as in the preceding year, showing a slight decease, the number of births more than doubled. The remarkable increase in the birth-rate from 16·10 per mille of population in the preceding year to 36·08 in the year under report, is stated to have been "the result of recovery from famine conditions and probably also of improved registration." It may be taken as some indication of the improvement in registration that the percentage of male to female births recorded fell from 119·15 in the previous year to 115·25 in the year under report. Some idea of the defective condition of the registration of vital statistics still prevailing in the Native States may be gained from a study of the table in paragraph 8 of the Report. Whilst a birth-rate of 18·38 for the Native States, as a whole, is recorded, one of the largest of them returns a rate of only 11·05 ; another of 4·27 ; and a third of 2·29, per thousand of population. It is the same with the record of deaths. Whilst the general death-rate is stated to be 17·10, several States return ratios of less than 15 ; and one State a ratio of only 2·0. Calculated on the number of children under one year of age living when last census was taken, the infantile death-rate works out to no less than 609·69 per thousand. If, however, the rate is calculated on the births recorded for the year under report, it is found to be only 216·9 per thousand. But for the exceptionally large number of children born during the year under report, the death rate for Ajmer-Merwara would have been lower than recorded ; for it is evident that the addition to a population of less than half a million of 17,207 persons who died at the rate of 216 per thousand, compared with a death-rate of only 32·86 per thousand at all ages, must have a marked effect in raising the general death-rate.

3. Of the chief diseases, *cholera* accounted for only 32 deaths in Ajmer-Merwara ; giving a ratio of 0·07 per mille of population, as compared with a mean of 2·06 for the previous five years. From the Native States 1,519 deaths were reported from this disease ; but no great reliance can be placed on these figures. *Small-pox* was almost entirely absent from the Ajmer-Merwara Division, having been credited with only three deaths during the year. Vaccination continued, as in former years, to yield extraordinarily high percentages of successful cases. In primary vaccination, according to the return on page 28 of the Appendix of the Report, a percentage of 99·18 was attained in Ajmer-Merwara, and of 98·91 in the Native States. In the Native State of Kishnagarh, of 1,786 primary vaccinations all are returned as having been successful. In paragraph 38 of his Report the Residency Surgeon and Chief Medical Officer states that he "gave considerable attention to the high percentage of successful vaccinations." In certain other provinces it has been found that some vaccinators adopt a method of preparing their registers which enables them to return all their operations as "successful." At the time of vaccinating they enter the names and other particulars of each case on a slip of paper, and not in the Departmental printed or lithographed register. When they return, after a week, to ascertain the results of their operations, they strike out from this slip of paper the unsuccessful cases before transcribing the names into the permanent official register. In this way they are able to show all their operations to have been successful ; whilst the most careful examination by the inspecting officer fails to detect any mistake in the registers. It may possibly be from their adoption of this, or some other ingenious method in the preparation of their returns that vaccinators in Rajputana are able to show the striking results published in the annual reports,

4. Of the comparatively few cases of plague reported in Ajmer-Merwara, nearly all were imported, only two deaths occurring amongst the indigenous population. In the Native States of the province 1,070 cases with 869 deaths were recorded.

5. Over-crowding existed in the Ajmer jail ; but although the daily average number of sick increased from 7·58 in the previous year to 12·38 in the year under report, the death-rate fell from 36·18 to 29·60 per mille of the jail population. There was a satisfactory decrease in the mortality from dysentery and diarrhœa, as well as from lung and respiratory diseases, ordinarily the most fatal diseases of Indian jails. In the jails of some of the Native States the sickness and mortality continue to be excessive. The Banswara jail maintains its evil reputation ; its death-rate rose from 129·35 in the previous year to 272·28 in the year under report. "It is proposed," the Chief Medical Officer writes, "to construct a new jail on a healthy site." The Dungarpur jail, with its death-rate of 217·47 per thousand of average strength, would appear to be little behind that of Banswara in point of unhealthiness. Such figures may be left to speak for themselves.

21st July 1904.

No. 10.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Madras for 1902.

The Report of the Sanitary Board precedes that of the Sanitary Commissioner. The functions of the Board are neither administrative nor executive but advisory only. During the year many sanitary schemes were examined of an estimated cost varying somewhat over seven thousand rupees to upwards of five lakhs each. Some new type designs were also prepared, and such questions as the destruction of rats, latrine accommodation and mortuaries considered.

2. The Sanitary Report begins with a brief but useful account of the season's rainfall, and of the prices of the ordinary food of the people. The rainfall is described as having been favourable. It

measured 53·73 inches as compared with 47·80 in the previous year, and with a decennial average of 44·89. Following the good rainfall, food grains were less expensive. The effect of these conditions on the public health is shown in an increased birth-rate and a diminished death-rate. Emigration at the same time declined, as it is said to do in prosperous years, immigrants exceeding emigrants by 47,505.

3. The *birth-rate* of the Presidency rose to 28·2 per thousand of population, showing an increase over that recorded for the previous year, but still falling short of the mean ratio of the previous five years by 0·7. There can be no doubt that, owing to defective registration, these figures fall far short of the real birth-rate. The birth-rates recorded in the adjoining provinces of Bombay and Bengal for the same year were 34·16 and 40·14 respectively. In contrast with the general rate of 28·2 recorded for the Presidency, "61 towns under municipal rule where compulsory registration of births and deaths is enforced by the employment of special staffs," with an aggregate population of close upon two and a half millions, record a birth-rate for the year of 32·7 per mille. From which it may be inferred that more efficient registration has enabled those towns to show a higher birth-rate than the rural and town circles in which registration is not compulsory. The Sanitary Commissioner has suggested to the Government that in 306 villages, lying in 21 districts, where medical subordinates are employed, the services of these men might be utilized for the purpose of registering deaths according to their causes. In this way, he thinks, "a gradual accumulation of evidence as to correct nomenclature and distribution of diseases" in the Presidency would be secured. The experiment proposed would deal with a population exceeding two millions, and if carefully carried out would undoubtedly furnish a reliable record of the actual number of deaths and of the diseases to which these deaths were due. The suggestion does not, however, commend itself to Government.

4. Owing chiefly to the diminished prevalence of cholera, the *death-rate* of the year under report has fallen to 20·2 from 21·1 in the previous year. The actual rate is undoubtedly much higher than the recorded rate. No fewer than 11 districts return death-rates of less than 20 per thousand of their population; and one of these, Ganjam, records a rate of only 11·9. In the case of deaths, as of births, the ratio recorded in town circles is much higher than that recorded in rural circles. Whilst in the former the rate was 28·2, in the latter it was only 19·3. Registration of vital statistics may be, and doubless is, defective in the towns, but it is obviously more so in the country. The recorded infantile death-rates in urban and rural areas are consistent with this belief. In the former the infantile death-rate recorded was 233·3 per thousand births; in the latter it was only 168. The Sanitary Commissioner thinks there is room to believe that both rates represent facts as found. In this opinion the Government, for reasons which appear to be conclusive, is unable to concur.

5. Of the chief diseases, *cholera* had attributed to it a death-rate of 0·8 per mille of population. The most important fact connected with the history of the disease during the year is the employment of Certificated Sanitary Inspectors for dealing with cholera outbreaks, in place of the vaccinators and others hitherto deputed on this duty. The change cannot fail to be beneficial. Experience has clearly shown that, in preventing or cutting short cholera outbreaks, efficient sanitary arrangements can alone be relied on. Medical treatment of people attacked by the disease may alleviate individual suffering, but can have little, if any, influence on the progress of an epidemic.

6. *Small-pox* was credited with 24,967 deaths, equal to a ratio per thousand of population of 0·7. This was the ratio recorded for the preceding year, and also the mean for the five previous years. With this may be contrasted the mortality from small-pox in the neighbouring presidency of Bombay. In the year under report the ratio of deaths per thousand of population in Bombay was 0·12; whilst the mean for the previous five years was 0·24. The Sanitary Commissioner again urges the need for the reorganization of the Vaccination Department. He says: "I would take the liberty of repeating my trite statement that the *personnel* of the Vaccination Department in this Presidency is badly paid, badly educated, and, by reason of multiple masters, badly disciplined." It appears that the Inspector of Vaccination, who is also Deputy Sanitary Commissioner and Professor of Hygiene and of Practical Bacteriology in the Medical College, was prevented by his duties at the Medical College from making any inspections during the year. In the working of a department, like that of vaccination, employing a large number of subordinates on small salaries and scattered over a wide area, experience has everywhere shown the necessity for unintermitting supervision, if the quality of the work is to be maintained at a high standard and if the falsification of returns is to be prevented. There was some increase in the total number of vaccine operations and a slight decrease, from 91·0 to 90·7, in the percentage of successful cases. Commenting on the remarkably high percentage of success in cases of re-vaccination in certain districts, the Government doubts the accuracy of the statistics and is inclined to believe that many cases of secondary vaccinations are classified in the accounts as those of re-vaccination. Instead, however, of trying to make the Vaccinators understand the difference between "secondary vaccination" and re-vaccination, as the Government suggests, it might be simpler to omit the former term altogether from the registers and returns; it finds a place in the vaccination returns of no other Indian Province, excepting in those of Madras; and as its use seems to give rise to confusion without adequate compensating advantage, the expediency of discontinuing it might be considered. As usual, calf-to-arm vaccination gave the most successful results; glycerinated lymph, prepared locally, and used in municipalities in 27,052 cases, came next with a percentage of 97·3 successful cases, followed closely by animal lymph in tubes and plates with a percentage of 97·0. The glycerinated lymph, locally prepared in different centres and used in 431,905 operations in local fund areas, yielded a percentage of only 87·4 successful cases. The use of humanized vaccine lymph has been entirely discontinued in the Madras Presidency; but this description of lymph still continues chiefly to be used in the other provinces of India and to yield high ratios of successful cases.

7. The Madras Presidency, which has so long successfully resisted invasion by *plague*, records 10,795 deaths from that disease during the year under report. In all cases, as stated in the Government review of the Report, "the infection was brought into this Presidency from territories beyond

the control of the Government of Madras." In carrying out his system of observation of areas imminently threatened by plague, the services of his trained staff of Certificated Sanitary Inspectors have been utilized by Colonel King in the detection of imported cases, and in preventing those from becoming centres of infection. It has thus been found possible, he says, to trace the origin and progress of epidemics with greater accuracy than in areas where such means are not adopted. He adds : " it may be accepted that experience in this Presidency shows that man causes the rat to suffer and not the rat man in the first place, that the area over which rats roam is usually small, and that recrudescence is by no means a natural feature of the disease, but a very natural result of apathy or too optimistic treatment of an indigenous infected area." Such experience is worthy of record, in view of the opinion expressed by some of the Delegates at the recent International Sanitary Conference held at Paris, regarding the part which rats play in the spread of plague.

8. The mortality ascribed to *fevers* and to *dysentery* and *diarrhœa* is fractionally less than in the previous year. Under the head of "all other diseases" no less than 45·7 per cent. of the deaths from all causes were registered. With the agencies available for the collection and record of vital statistics, registration of deaths according to their exact causes cannot reasonably be expected.

9. In Madras, as elsewhere in India, the want of funds is the main, although not the invariable cause of the slow progress in the execution of *Sanitary works*. Many schemes for providing towns with pure water supplies and drainage systems have been prepared in readiness for being put in hand when funds became available. From the Sanitary Engineer's Report, which follows that of the Sanitary Commissioner, the action of the Municipality of Guntur may be quoted as an instance of the refusal of a municipal town to provide itself with an urgently-needed water supply, even when funds for the execution of the undertaking are available. Owing to the water famine, which was the cause of severe distress to the inhabitants of Guntur, the Council was urged to construct immediately a brick culvert for conducting water from a spring into their town. "By this time, however, the water famine had abated, and the Council resolved not to carry out any portion of the permanent works. The Council is well able to afford the cost of the works proposed; and it is a matter for regret that the absolute necessity for the contruction of the permanent works has not been pressed on the Council." From which example it may be concluded that lack of zeal for the public good may sometimes take the place of lack of funds in retarding the execution of urgently-needed sanitary improvements.

21st July 1904.

No. 11.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Bombay for 1902.

More than a page of the Report is given to a somewhat prolix account of the rainfall for each month of the year and for each district of the Presidency; but from this no conclusion is drawn as to the influence the weather may have exercised on the public health. Judged by its vital statistics, the year was an unhealthy one; the deaths exceeding the births by 90,069. This result was due to an increase in the fatality of plague, which, of itself, accounted for upwards of a fourth part of the total mortality of the year.

2. The *birth-rate* of 34·16 per thousand of population was in excess of that recorded for each of the two previous years, and also of the mean for the ten years 1892–1901. The birth-rate of rural areas greatly exceeded that of urban areas; whilst the former was 35·23, the latter was only 27·09. The Sanitary Commissioner says: "The chief cause of the difference in the urban and rural birth-rates is due to defective registration." It might have been expected that fewer births would have escaped registration in towns than in the country; but the figures given would suggest an opposite conclusion. In the neighbouring Presidency of Madras the urban birth-rate exceeds the rural birth-rate; the former was 29·2 and the latter 28·1 per mille of the population for the year under report. The rural birth-rate in the Bombay Presidency exceeds the urban birth-rate by 8·14; the urban birth-rate in the Madras Presidency exceeds the rural birth-rate by 1·1. The difference is probably due rather to the mode in which registration is effected than to a reversal of the relative fecundity in urban and rural areas in the two Presidencies. The high ratio of still-born children in Bombay City has frequently been commented on, but never satisfactorily accounted for. In the opinion of the Health Officer it is due to "plague, the laborious occupation of females working under very trying circumstances in mills, factories, &c., and to the age at which women become mothers." A reference to the returns of vital statistics prior to the appearance of plague in Bombay proves conclusively that the high ratio of still-births in that city is not due to the prevalence of plague. Without going further back than 1895, the still-births registered during that year in Bombay City numbered 1,470 against 15,684 live births. This would give a ratio of upwards of nine per cent. The number was the same in the preceding year; yet the plague did not appear until towards the end of 1896. Nor can the high rate of still-births be due to the employment of women in factories, if, as stated in the Government review of the Report, "the number of women so employed is small." As to the last of the causes assigned for the high ratio of still-births, the age at which women become mothers in Bombay, we have met with no statistics which would show that this substantially differs from the ages at which women generally become mothers in other Indian cities.

3. The *death-rate* for the year under report rose to 39·04 from 37·12 in the preceding year, and exceeded the decennial mean by 2·62 per thousand of population. The increase was due to plague. The death-rate recorded for the urban population was 60·22, as compared with 35·85 for the rural population. In some towns death-rates of upwards of 150 per thousand were recorded. These high rates were attributed, in most part, to plague.

4. Of the *chief diseases*, *cholera* was in marked abeyance during the year. Only 3,229 deaths were attributed to it, the lowest number on record since 1886. No sufficient explanation has yet been given of the remarkable variations in the incidence of cholera from year to year. In this Presidency the returns show that the deaths caused by it were four times more numerous in the preceding year and fifty times more numerous in 1900 than in the year under report. Water being generally regarded as the medium by means of which cholera is communicated, it naturally comes to be asked why this should vary so greatly in purity from one year to the next.

5. *Small-pox*, like cholera, was less prevalent than during the previous year. The ratio of deaths due to it per thousand of population was only 0·12, as compared with 0·24, the mean for the previous five years. The highest death-rate recorded in this Presidency during any one year of the past 12 was only 0·52, figures which bear testimony to the efficiency of the Vaccination Department. During the year under review the number of primary vaccinations increased by 66,472; whilst the number of re-vaccinations decreased by 9,335. The percentage of success in primary operations, excluding those regarding which the results were not ascertained, was 98·91. Of the re-vaccinations, excluding "unknown" cases, the percentage of success was 82·78. In the Bombay Presidency, as in most of the other provinces of India, with the exception of Madras, humanized vaccine lymph is still chiefly used; and the results given by it are more successful than those obtained from any other kind. Only 70 cases were vaccinated with "glycerinated lymph," and the percentage of success in those was as low as 45·71. Lanoline paste gave a percentage of 84·18 successful cases. A favourable feature of the year's work is the large number of infants protected by vaccination. Of the infants available for vaccination, 71·85 per cent. were successfully vaccinated in the Presidency, excluding the Native States and Aden.

6. The mortality from *fever*, *dysentery*, *and diarrhœa* showed, as in the case of cholera and small-pox, a decrease as compared with that recorded in the preceding year. In short, but for the increase in the number of deaths due to plague, the year, as estimated by its death-rate, would have been a comparatively healthy one. From plague the number of deaths was the highest hitherto recorded in the Presidency, reaching as it did a total of 184,762, or 56,503 in excess of the previous year's number. Under the heading "other diseases" there was a marked decrease in the number of deaths; but this decrease is only apparent and is due to the deaths from *respiratory diseases* being now, for the first time, shown separately, instead of being included, as heretofore, in the total of those returned under the head of "other diseases."

7. The Sanitary Commissioner says: "Real sanitary progress has been at a standstill for some years past." The main cause of this was, doubtless, the disastrous epidemic of plague which, beginning so far back as September 1896, shows as yet no signs of abatement. Quoting from the Government Resolution on the Report: "Very few towns in the Presidency have escaped severe outbreaks of plague, which have burdened many with heavy debts." From which it may be understood that the direct cause of the retardation of sanitary progress is the exhaustion of funds resulting from expenditure on measures connected with the combat against plague.

8. The Sanitary Commissioner makes complaint of the frequency of the changes among his deputies, and very truly observes that "it is difficult for work to be properly supervised with such frequent changes." Although these changes are acknowledged by the Government to have been frequent, they are said to have been unavoidable.

9. Appended to the Sanitary Report is the Annual Report of the Health Officer of the Port of Bombay. The magnitude of the task with which the Port Officer had to deal may be realised from the statement that during the year 15,432 vessels of sorts, with crews and passengers numbering 701,964, were examined; whilst the clothing and bedding of 93,479 crew and passengers of outgoing and incoming vessels were disinfected. "Each individual who left the port was subjected to a rigorous and searching examination for any symptoms suspicions of plague. In addition to this examination, the personal clothing and bedding of such crew and passengers as came under the disinfection rules were thoroughly disinfected." At the recent International Sanitary Conference held at Paris, those of the Delegates who had made themselves acquainted with the measures adopted at Bombay for preventing the spread of plague infection from that port by sea were unanimously of opinion that these measures were carefully and successfully carried out.

21st July, 1904.

No. 12.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner for the Hyderabad Assigned Districts for 1902.

The most striking feature in the history of the public health for 1902 was the remarkable rise in the birth-rate. From 30·8 per thousand of population in the previous year, this reached 56·9 in the year under report, and was the highest recorded during the preceding 31 years. The history of other provinces furnishes many examples of similar increase in the birth-rate during a prosperous year immediately following a season of severe privation.

2. The abnormally high birth-rate was accompanied by a rise in the death-rate from 27·6 to 32·8 per thousand of population. Except for an outbreak of plague, the year was, however, a very healthy one. Cholera was almost absent from the province, only 16 deaths having been attributed to it; whilst the death-rate from small-pox only amounted to 0·1 per mille of population. The infant death-rate for the year under review was 620·1 per thousand in the case of male, and 523 in the case of female, children living, according to Annual Form No. IV. in the Appendix to the Report; but only 203·8 in the case of the former and 182·9 in the case of the latter, calculated on the number of births registered during the year under report. During the previous year the ratio of deaths amongst infants, calculated on the numbers living, was in the case of male children only 337·4, and in the case of female children 291·0, or not very much more than half the ratios for 1902. But any estimate of the comparative health of the two years, based on those figures, would be erroneous. In the one year, a smaller number (83,762) of children furnish the 16,485 deaths registered; and in the other year, a larger number (154,954) furnish the 29,992 deaths registered. In the case of both years alike, the death ratio is calculated on the same infant population numbers, with the inevitable result that the year under report, with its larger number of deaths of infants, shows a higher ratio of infant mortality than its predecessor. If, however, the calculation is made on the number of children born during each of the two years, the ratio of deaths amongst male children under one year of age will be found to be 203·8 in the year under report, as compared with 205·3 in the previous year; and amongst female children 182·9, as compared with 187·9. The positions of the two years are thus reversed in respect of the infant mortality recorded for each, and the year under report shown, as far as these figures can be taken as a safe guide, to have been healthier, instead of much more unhealthy, than the preceding year.

3. *Plague* was the only one of the *chief diseases* which showed a marked increase. The disease attained a firm foothold in the province and accounted for 4,188 deaths. The Civil Surgeon of one district states that "the disease was introduced by infected rats in goods wagons." Very clear proof would, however, be required before such a statement could be accepted, and none of any kind is given. As the resut of the experience gained in dealing with plague in Madras, the Sanitary Commissioner of that Presidency believes that, in the first instance, the disease is communicated by man to rats and not by rats to man. But the exact part played by rats in the dissemination of plague, is still uncertain. It is interesting to learn from the report "that although Banjaras (the gipsy tribe) have free communication with infected areas, not a case of death from plague had been recorded among them, thus clearly showing that the open-air life these people lead is a preventive against plague"; and also, it might be added, still further confirming the belief that the evacuation of plague-infected towns and villages is the most efficacious means yet discovered of bringing about the extinction of an outbreak of the disease.

4. The best proof that *vaccination* continues to make good progress and to fulfil its purpose in the province, is the steady decrease of the mortality from small-pox. On page 7 of the Vaccination Report for 1902–03, a statement is given of the ratios of mortality from small-pox in consecutive five-year periods, commencing from 1868–69. For the first of these periods the ratio of small-pox deaths per thousand of population was 2·02. During the following six periods the decrease has been uninterrupted, until for the last of them, that ending with 1902–03, it has fallen to 0·15. During the year under report, the number of vaccine operations performed shows an increase over that of the previous year of 20,646. This increase is said to have been due to the extrordinarily high birth-rate of 1902. The percentage of successful cases in primary vaccination was 96·8; whilst in re-vaccinations it was, as usual, very low in this province, having been only 16·5. This low percentage of success in re-vaccination cases may be due, in part, to the high quality of the primary vaccination, or to a stricter test having been applied before deciding a case of re-vaccination to be successful, than is usual in other provinces.

5. Regarding *sanitary works*, municipalities are said to have laid out a fair share of their income in their promotion. In rural areas, "useful work is gradually being done in providing wells, and land for purposes of nature, and in cleaning up village sites and filling up pools; but the progress is necessarily slow."

21st July, 1904.

No. 13.

Memorandum by the Army Sanitary Commission on the Administration Report of the Town of Calcutta for 1902–03.

During the past three years, or since the amended new Calcutta Municipal Act came into force in 1899, the Health Department has undergone reorganization. With the introduction of the new Act sanitary measures, under the stimulus of the plague epidemic, have been vigorously prosecuted. Owing to the recurrence of plague the public health of the year, as measured by the mortality, was bad. But for plague the death-rate would have been little, if at all, in excess of the mean recorded for the preceding decade.

2. The *birth-rate* of 14·2 per thousand of population, although considerably higher than that recorded for the previous year, when it was only 10·7, is still abnormally low. The expectation that

the division of the City into four districts would lead to improved registration of vital statistics has only to a limited extent been realised. The Health Officer has worked out an estimate of the birth-rates of the three Presidency towns, based on the number of women living in each between the ages of 15 and 40 years. Assuming the fecundity of the women at these ages to be approximately the same in each of these towns, he finds that 1·28 births are registered in Bombay, and 2·44 in Madras for every one registered in Calcutta. It further follows, he says, that if the registration in Calcutta were as efficiently carried out as it is in Madras, the birth-rate of the former would be 26·3, or nearly double the rate actually recorded. He recommends the adoption in Calcutta of the system of registration of births which has yielded so good results in Madras. The number of still-births was 4·9 per cent. of the total births including the still-born. In the City of Bombay, similarly calculated, it was 10·2, or more than double.

3. The *death-rate* recorded for the calendar year 1902 was 37·0 per thousand of population, as compared with 38·1 for the preceding year. The high death-rates of both years were due to the epidemic prevalence of plague. The infant mortality was very high ; a ratio of 338·6 deaths per thousand of population having been recorded for children of less than one year of age. Calculated on the number of births, this ratio was 491·0 per thousand ; that is to say, approximately half of the number of children born died.

4. Of the *chief diseases*, *plague* was the most destructive of life. According to the returns for the calendar year 1902, the deaths due to this cause numbered 7,278, equal to a ratio per thousand of population of 8·5. But there can be no doubt that the mortality from plague was greater than these figures would indicate. As the Health Officer observes, plague deaths were often falsely registered under other heads, as always happens during epidemics. The disease is said to have been of a more virulent type than during any of the previous epidemics, "the high case mortality being the subject of remark amongst both patients and practitioners." It is also stated that, as in previous years, there has been a wide-spread epidemic among rats, which reached its maximum in the beginning of January, and declined before the epidemic among human beings broke out. It is also added that "the fact tends to support the belief that rat mortality precedes the appearance of epidemic plague." The Sanitary Commissioner of Madras believes, on the contrary, as the result of experience in the Madras Presidency, that plague amongst human beings precedes its appearance amongst rats. The Chief remedial measures adopted in Calcutta have been disinfection of plague-infected rooms and huts, and the demolition of the latter under the plague regulations where disinfection could not be efficiently carried out. The attitude of the people towards the measures adopted is said to have been more friendly than in former years, and the amount of voluntary evacuation of plague-infected dwellings in some parts of the town striking ; whilst disinfections have been frequently applied for.

5. From *cholera* the mortality exceeded the mean for the preceding ten-year period and was only higher in two of those ten years. The death-rate from this cause amounted to 3·2 per thousand of population. For the Province of Bengal, as a whole, it was 2·02 ; and for the district of the 24-Parganas, which nearly surrounds Calcutta, 4·7. "Consequently," writes the Health Officer, "many cases were imported and formed foci of disease." No evidence is given in support of this assertion. The year having been one of epidemic prevalence of cholera in Bengal, it seems reasonable to conclude that the conditions which favoured the development and spread of the disease in the country surrounding Calcutta would not be inoperative in Calcutta itself. The mortality due to cholera in the 24-Parganas was certainly somewhat higher than in the town of Calcutta, a difference which might perhaps find its explanation in the greater purity of the filtered water-supply enjoyed by Calcutta, otherwise, so far as evidence is available for the support of either assertion, it might be contended with equal force that, instead of being conveyed from the country into the town, cholera was conveyed from the town into the country. Under similar circumstances of the synchronous prevalence of cholera in Madras and in the surrounding villages, the Health Officer of that City writes : "It has always been a discussion whether these villages were the means of introducing cholera into the city or *vice versa*."

6. *Small-pox*, to which 2,097 deaths were due in the preceding year, was credited with only 127 in the year under report. The results which have followed the abolition of the former Vaccination Department and the creation, in its place, of a system in accordance with which vaccination is carried on by Hospital Assistants acting under the four Health Officers are not considered to have been satisfactory. The number of vaccine operations performed has decreased by more than half as compared with the number performed in the preceding year. This decrease was, no doubt, partly due to the cessation of the epidemic of *small-pox* which had prevailed during the previous year, and which had induced a larger number of people than usual to get vaccinated. Moreover, the Health Officers thinks the work of vaccination suffered from the District Health Officers and the Hospital Assistants being new to the work, from constant changes amongst the staff, and from insufficient supervision.

7. The number of deaths attributed to *fevers* is less than the number recorded for the preceding year, and much less than the mean for the previous ten-year period. This decrease may not, however, be due to diminished prevalence of these diseases, but partly to improvement in the registration of deaths according to their causes. The Health Officer states that, "from the month of June, all the cases of death that occurred in the town were inquired into and were reported on by the Sanitary Inspectors, who are nearly all qualified medical men." The initiation of the system of inquiry may result in the issue of reliable returns of deaths in Calcutta, according to their exact causes, which may serve as a standard by which the accuracy of the returns of deaths according to their causes in other Indian communities may be approximately measured. Hitherto, although persistent attention to registration has by degrees secured comparatively correct returns of deaths, in so far as their numbers are concerned, there has been no corresponding improvement in the registration of deaths according to their causes. The inquiry instituted by the Health Officer has already elicited important information regarding the loss of life annually caused in Calcutta by phthisis. This loss, the Health Officer is satisfied, amounts to at least 10 per cent. of the total mortality from all causes.

8. *Drainage works* on a vast scale are in progress in Calcutta. The difficulties which surrounded the suburban drainage scheme have been overcome. The conversion of the intermittent into a continuous *water-supply* is being carried out. The presence of plague has added to the urgency of the need for *bustee improvement*. In the words of the Report: "In any scheme for a general improvement of the health of the city the re-modelling of bustees must occupy a foremost place. Overcrowding, want of air space, light and drains, and the absence of proper conveniences are the prominent faults in existing bustees, and these can be remedied only by wholesale measures."

21st July 1904.

No. 14.

Memorandum by the Army Sanitary Commission on the Administration Report of the Madras Municipality for 1902–03.

The sanitary history of the year is gathered from the few pages given to an explanation of the annual returns of vaccination and vital statistics. The year was healthier than either of its two predecessors; but its death-rate was still upwards of 40 per thousand of population, and somewhat in excess of the average of the ratios of the previous ten years. The rainfall was above the average by 5·42 inches; the total fall having been 54·44 inches. Excepting September and October, all of the other months recorded a temperature above the average.

2. Estimating its quality by the influence it has in protecting the people against small-pox, *vaccination* yielded better results in Madras than in the other great Indian cities. The death-rate from small-pox was only 0·1 during the calendar year 1902, and this was the average for the previous ten years. The number of cases vaccinated during the official year 1902–03 shows a decrease of 5,956 as compared with the number for the previous year. This is said to have been due to the smaller number of emigrant coolies vaccinated. Probably nearly all of those coolies would already have been vaccinated, or have had small-pox; so that the decrease in the total number of operations would take place under the head of re-vaccination. As a matter of fact, the cases of primary vaccination show not only no decrease, but a slight increase over the number recorded for the previous year. The percentage of successful cases in primary vaccination was 98·67, or slightly below that recorded in 1901–02. In re-vaccination there was a slight decrease in the percentage of successful cases from 70·59 in the previous year to 69·28 in the year under report. As pointed out in the Government review of the Report, the figures given in paragraph 139, with the object of comparing the percentage of successful cases following the use of different kinds of lymph, are not of much value, seeing that they do not distinguish between cases of primary vaccination and cases of re-vaccination. Whichever one of the three kinds of lymph mentioned is employed for re-vaccination would, almost certainly, yield a lower percentage of successful cases than the other kinds, provided that the latter were used only in primary vaccination. The large number of 1,020 prosecutions under the vaccination bye-laws testifies to the thoroughness with which these laws are enforced in the city of Madras; and to this is, doubtless, mainly due the comparative immunity from small-pox enjoyed by its inhabitants.

3. The *birth-rate* fell from 37·0 per thousand of population in the previous year, and from an average of 40·6 for the decade, to 34·8 in the year under report. This decrease is attributed to the high price of food and the prevalence of epidemic disease in 1901, "both of which seriously affect the health and vigour of the population, and therefore its fecundity." Moreover, the female, population of the city, once in excess, has steadily declined until, when the last census was taken, the male exceeded the female population by over five thousand. Without questioning the influence of these causes in tending to reduce the number of births, the Government is of opinion that the possibility of defective registration should be fully considered before other explanations of a decreased birth-rate are accepted.

4. A death-rate of 42·0 per thousand of population was recorded for the year. This, though less than the rate for the preceding year, when it was 46·2, is almost double what it might be, and what it may become, when the insanitary conditions to which the unhealthiness of Madras is known to be mainly due have been removed. Reduction of the death-rate is not to be looked for so long as parts of the town remain in the state described in paragraph 163 of the Report. "The streets are narrow and are literally used as latrines by children in the day and adults after dusk. Low-built, mud-walled houses, with no proper flooring, in such a dangerously polluted soil, must, of necessity affect the death-rate of the place. It is literally a case of 'excrement-sodden earth, excrement-reeking air, and excrement-tainted water,' and no wonder, therefore, that it is the home of cholera and other epidemic diseases."

5. From *cholera* and *small-pox* the town suffered comparatively little during the year, only 37 deaths having been caused by the former and 69 by the latter; but *fever* had ascribed to it 7,326 deaths, as compared with an average of 6,129 for the decade. As noted in the Report, however, no opinion as to the real causes that led to this high mortality is possible so long as registration remains in its present defective condition.

6. The City, as well as the Presidency of Madras generally, continued to enjoy remarkable immunity from *plague*. Of the 13 cases of the disease which occurred in the city during the year

not one was indigenous; all were imported. The passport system, which has been carefully maintained in force from the time that Madras was first threatened with an invasion of plague, has hitherto proved successful in preventing the disease from obtaining a permanent footing in the town.

7. The new *drainage works* were in progress during the year, and already upwards of fifteen lakhs of rupees have been expended of the thirty-two lakhs estimated to be required for their completion. The comparatively small sum expended in extending the *water-supply* to the whole of the city would appear to indicate that the progress of this work has not been repaid. The improvement of certain insanitary areas, to judge of their condition by the description given of them in the Report, is probably scarcely less urgent than the completion of the drainage and water-supply schemes.

21st July, 1904.

No. 15.

Memorandum by the Army Sanitary Commission on the Administration Report of the Municipal Commissioner of Bombay for the year 1902–03.

The Executive Health Officer's Report is so profusely interspersed with figured statements that the narrative portion of it is somewhat disjointed and difficult to follow. Some of the statements, if it was considered necessary to insert them, might have been relegated to the Appendix.

2. The year, as estimated by its record of vital statistics, was less unhealthy than any of its four immediate predecessors. Going back to 1896, the death-rate, which in that year was 40·71 per thousand of population, rose during each successive year until in 1900 it reached 96·55. In the following year it sank again to 76·66; and now in the year under report has fallen still further to 62·38.

3. The Health Officer considers the results achieved and the work done under the new scheme of birth and death registration proposed by him to have been satisfactory, In this scheme, which has been in operation for one year, the Health Officer himself occupies the place of Chief Registrar; and through his hands passes every detail regarding the record of birth and death statistics. The number of births registered during the year under report exceeded that registered during the preceding year by 4,079, the *birth-rate* rising at the same time from 17·42 to 22·67 per thousand of population. Yet, owing to the indifference of parents to the duty imposed on them under the Act to register all births, it is said that many of these still remain unregistered. The number of still-born children registered was 2,017 as compared with 2,153 in the previous year; but in consequence of the much larger number of births registered during the year under report than its predecessor, the proportion of still to live births is much less in the former than in the latter. In 1901 there were 16 still to every 100 live births; whereas in the year under report there were only 11·4 of the former to every 100 of the latter. These figures would appear to indicate that the abnormal proportion of still to live births hitherto recorded in Bombay City may have been in large part due to the incompleteness of the birth registration.

4. Whilst the birth-rate of the year showed a marked increase, the *death-rate* showed a still more marked decrease. From 76·66 per thousand of population in 1901 the latter fell to 62·38 in thye are under report. This decrease was chiefly due to less mortality from plague, cholera, remittent and relapsing fevers. From small-pox and measles there was a considerable increase in the number of deaths. The mortality amongst children under one year of age was, again, enormous, amounting as it did to 537·13 of every thousand births. The causes of this excessive infant mortality are not far, the Health Officer says, to seek. These causes he enumerates under nine heads, some of which affect the mother and others her offspring. Of this list of causes the incidence of none can be said to be peculiar to the mothers and children of Bombay City, although, as in other large cities of India, the prevailing insanitary conditions are doubtless more concentrated, and consequently more inimical to health, than in less densely populated places. On looking over the last Census Report, the Health Officer finds that 80 per cent. of the total population of the City live in tenements of one room with an average of four to five occupants. Such overcrowding, combined with poverty, is incompatible with healthy life all the world over; and so long as it is permitted to exist, little diminution of the bills of infant mortality need be looked for. During the year under report, the infant death-rates of the cities of Calcutta and Madras were, for the former 491·0, and for the latter 303·9, as compared with 537·13 for Bombay, per thousand births. Calculated on the number of children under one year of age when the last Census was taken in 1901, the death-rate for Calcutta works out to be 338·6, for Madras 395·1, and for Bombay 782·2. The enormous rate for Bombay the Health Officer explains to be due to the Census of 1901 having been taken in the month of March when plague was at its height, and when "the Census figures did not give an accurate return of the normal infant population." The death-rates calculated on the number of births registered during the year are certainly more likely to yield trustworthy results than those calculated on the numbers of children living when the last Census was taken; but in whichever way calculated the infant mortality is shown to be excessive.

5. Of the chief diseases, *cholera* was in comparative abeyance. It prevailed in a sporadic form throughout the year, no month being altogether free from it, and was the cause of a total of 75 deaths. Of these deaths only 10 occurred amongst persons whose birthplace was the City of Bombay.

6. *Small-pox* had 288 deaths ascribed to it, as compared with 159 in the previous year, and with 746, the average of the preceding five years. An Abstract of the monthly Returns of Vaccination is inserted in the Health Officer's Report; but no comment is made thereupon. It appears from this

return that the successful primary vaccinations numbered 13,292, and the successful re-vaccinations 363. The successful primary operations exceeded in number those of the previous year by only 347 ; whilst the children born exceeded those of the previous year by 4,070. Consequently, although the total number of children successfully vaccinated slightly exceeded that for the previous year, there was a large failing off in the *proportion* of successful vaccinations to number of children available.

7. The mortality from *fevers* shows a marked decrease, the deaths ascribed to them having been only 4,518 as compared with 7,921 in the preceding year. Of this total, 3,847 were due to the remittent type of fever. The number of deaths attributed to *enteric fever* increased to 89, or 27 more than in 1901, and 42 more than the average of the past five years. *Relapsing fever*, although far less fatal than in the previous year, was still accountable for 651 deaths. The Health Officer states that the fever mortality rose and fell with the mortality from plague ; and this suggests that the number of deaths ascribed to plague is probably less than the actual number.

8. *Plague* was credited with 13,820 deaths, as compared with 18,736 in the previous year. The Health Officer considers the year to have been an unique one in the history of plague epidemic in Bombay. "Considering the fact," he writes, "that the population of Bombay was full in 1902, and all plague measures were voluntary, and that cholera, small-pox, and measles were to some extent prevalent in the city, it would appear that the mortality of 1902 is the lowest that was recorded in any previous epidemics (with the same unfavourable circumstances)." But sanguine anticipations regarding the future course of plague in Bombay do not appear to derive much support from an examination of the mortality returns recorded on page 174 of the Report. The question of the part played by rats in the spread of plague infection is still unsettled. Whether rats convey infection to man or man to rats is, according to the Health Officer, "only a matter of conjecture" ; but in a subsequent paragraph of his Report it is stated that "it is communicable from man to man by direct and indirect infection. It is communicable from man to rats and through rats to man." As to the most effectual measures for extinguishing the disease, he says : "The only really valuable method we have of checking the spread of plague is by removing the infected to hospital, or thoroughly isolating them and the contacts to an uninfected locality and preventing any communication with infected areas. In no case where this has been thoroughly done has plague continued to spread." The question, however, is whether this is practicable ; and this question, as regards Bombay, has been definitely answered in the negative. What follows may be taken as evidence of the impracticability of carrying out such a proposal. "If," the Report continues, "we could remove 300,000 people from infected houses in Bombay for six months, isolate cases as they occur, keep the vacated houses empty, thoroughly disinfect them, demolish the insanitary quarters, prevent immigration from infected areas, plague would be under control and soon disappear." Even if the peculiar nature of the site of Bombay and the greatness of the popnlation to be dealt with did not offer almost insuperable difficulties to the enforcement of such a series of drastic measures, the passive resistance, or active hostility, of the people towards them have already demonstrated the futility of attempting to carry them into effect.

9. A brief account is given of the progress of sanitary improvement during the year. The drainage works are being pushed forward towards completion ; and what, in the present emergency, is perhaps a still more urgent measure, the demolition of ill-ventilated houses is being actively proceeded with. The difficulty will be to provide the evicted inmates with new and more sanitary dwellings.

21st July, 1904.

REPORT

ON

SANITARY MEASURES IN INDIA

IN

1903–1904.

LIBRARY OF THE BOMBAY BRANCH OF THE ROYAL ASIATIC SOCIETY

VOL. XXXVII.

Presented to both Houses of Parliament by Command of His Majesty.

LONDON:
PRINTED FOR HIS MAJESTY'S STATIONERY OFFICE,
By DARLING & SON, Ltd., 34-40, Bacon Street, E.

And to be purchased, either directly or through any Bookseller, from
WYMAN and SONS, Ltd., Fetter Lane, E.C.,
and 32, Abingdon Street, Westminster, S.W.;
or OLIVER & BOYD, Edinburgh;
or E. PONSONBY, 116, Grafton Street, Dublin.

1905.

[Cd. 2766.] *Price* 1*s.* 8*d.*

CONTENTS

REPORT.

PAGE

I. EUROPEAN ARMY:

Sickness and mortality in 1903 ... 5
In Commands. 5
In Groups of Stations 6
Cholera 6
Small-pox 6
Fevers 6
Bowel complaints 7
Abscess of the liver 7
Plague 7
Venereal diseases 7
Invaliding 7

II. NATIVE ARMY:

Sickness and mortality in 1903 ... 8
In Commands... 8
In Groups of Stations 9

III. GENERAL POPULATION:

Vital Statistics 10
Bengal 10
United Provinces of Agra and Oudh 11
Punjab... 12
North-West Frontier Province ... 13
Burma 13
Central Provinces and Berar ... 13
Assam 14
Madras... 15
Bombay 15

IV. JAILS:

Sickness and mortality in 1903 ... 17
Bengal 17
United Provinces of Agra and Oudh 18
Punjab... 18
North-West Frontier Province ... 18
Burma 18
Central Provinces and Berar ... 19
Assam 19
Madras... 19
Bombay 19

V. VACCINATION:

General results 20
Bengal 20
United Provinces of Agra and Oudh 21
Punjab... 21
North-West Frontier Province ... 21
Burma 21
Central Provinces and Berar ... 21

PAGE

V. VACCINATION—*continued*:

Assam 22
Madras... 22
Bombay 22

VI. MEDICAL INSTITUTIONS:

Civil Hospitals and Dispensaries:

Bengal 23
United Provinces of Agra and Oudh 24
Punjab... 24
North-West Frontier Province ... 25
Burma 25
Central Provinces and Berar ... 25
Assam 25
Madras... 25
Bombay 26

Lunatic Asylums:

Bengal 26
United Provinces of Agra and Oudh 26
Punjab... 26
Burma 26
Central Provinces 26
Assam 27
Madras... 27
Bombay 27

Medical Schools:

Bengal 27
United Provinces of Agra and Oudh 27
Punjab... 28
Madras... 28
Bombay 28

VII. SANITATION:

Civil:

Bengal 29
United Provinces of Agra and Oudh 29
Punjab... 29
North-West Frontier Province ... 30
Burma 30
Central Provinces and Berar ... 30
Assam 30
Madras... 31
Bombay 31

1625 Wt 2979 11/05 D & S 6 21397

ABSTRACTS.

	PAGE.
India Sanitary Report for 1903:	
Meteorology of the Year	35
European troops	37
Native troops	60
Jails	72
General population	83
History of chief diseases (including plague)	90
Vaccination	108
Sanitary works	114
General remarks	121
Madras Sanitary Report for 1903:	
General population	132
Chief diseases	135
Sanitary works	141
Bombay Sanitary Report for 1903:	
General population	145
Chief diseases (including plague)	147
Sanitary works	151
General remarks	151
Shipping and Health of the Port of Bombay	153
Calcutta Municipal Report for 1903–04	159
Calcutta Health Report for 1903	163
Madras Municipal Report for 1903–04	167
Bombay Municipal Report for 1903–04	171
Bombay Health Report for 1903	172

APPENDIX.

Memoranda by the Army Sanitary Commission on:—	
India Sanitary Report for 1903	176
Bengal Sanitary Report for 1903	180
United Provinces of Agra and Oudh Sanitary Report for 1903	183
Punjab Sanitary Report for 1903	184
North-West Frontier Province Sanitary Report for 1903	187
Burma Sanitary Report for 1903	188
Central Provinces and Berar Sanitary Report for 1903	190
Assam Sanitary Report for 1903	192
Madras Sanitary Report for 1903	194
Bombay Sanitary Report for 1903	196
Calcutta Municipal Report for 1903–04	198
Madras Municipal Report for 1903–04	200
Bombay Municipal Report for 1903–04	201

A. GODLEY,
Under Secretary of State for India.

INDIA OFFICE,
31st October, 1905.

REPORT.

The present Report on Sanitary Measures in India during the year 1903 is prepared for presentation to Parliament. It contains chapters on the health of the European and Native troops, on the health of prisoners in jails, and on the health of the general population ; it also contains chapters on vaccination, on medical institutions, including medical schools and lunatic asylums, and a chapter on sanitary works. Appended to the Report are abstracts of reports by the three principal Sanitary Commissioners in India, and memoranda by the Army Sanitary Commission in England reviewing the several Sanitary Reports for India.

I.—EUROPEAN ARMY.

Sickness and mortality in 1903.

There was a marked improvement in the health of the European troops serving in India during the year 1903 ; the daily sick and invaliding rates were much lower than in the previous year, and the death-rate improved. On an average strength of 70,445, the admissions into hospital were in the ratio of 1,033 per 1,000, against 1,078 in 1902, the daily sick-rate fell from 66 to 63, and the death-rate from 14·68 to 13·05. The invaliding ratio (29) was lower by 8 per 1,000, so that the total loss by death and invaliding was equal to 42 per 1,000, a decrease of 10 per 1,000 on the previous year.

The following statement shows the relative extent of sickness and mortality among European troops in the four Commands and Burma District during 1903 and the previous year :—

Commands.		Average Strength.	Ratio per 1,000 of Average Strength.				
			Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
Bengal	1903	21,860	977	63	15·46	30	45
	1902	17,765	1,063	71	15·31	36	51
Punjab	1903	17,997	1,007	57	12·56	25	38
	1902	15,036	1,050	62	14·07	35	49
Madras	1903	9,375	1,071	73	7·79	34	42
	1902	8,422	1,009	66	7·96	36	44
Burma District	1903	3,616	1,172	73	13 00	30	43
	1902	3,675	1,317	81	11·96	54	66
Bombay ...	1903	15,990	1,115	65	12·32	33	45
	1902	14,404	1,125	67	19·58	43	63
INDIA ...	1903	70,445	1,033	63	13·05	29	42
	1902	60,540	1,078	66	14·68	37	52

It will be seen from the above statement that Madras and Burma had the highest sick-rates, and Bengal and Burma the highest death-rates. In regard to mortality, there was an improvement in all the Commands except Bengal and Burma district, where the death-rates rose from 15·31 and 11·96 respectively, to 15·46 and 13·00.

The chief causes of sickness in the whole European Army were venereal diseases and ague, the former yielding a ratio of 247 per 1,000 against 281 in 1902, and the latter 243 per 1,000 against 247. Forty-seven per cent. of the total sickness resulted from

these two causes. Enteric fever, as usual, was the chief cause of mortality, the death-rate from it being 4·19, slightly lower than the ratio of the previous year (4·29). Thirty-two per cent. of the total deaths were due to this cause.

Groups of stations.—The following table shows the sickness and mortality among the European troops according to groups :—

Groups.	Average Strength.	Ratio per 1,000 of Average Strength.		
		Admissions.	Daily Sick.	Deaths.
Burma Coast and Bay Islands	975	1,668	103	15·38
Burma Inland	2,408	1,005	65	11·63
Bengal and Orissa	1,912	1,226	76	15·17
Gangetic Plain and Chutia-Nagpur	6,831	947	67	16·98
Upper Sub-Himalayan	13,261	1,044	63	15·47
North-Western Frontier, Indus Valley, and North-Western Rajputana.	4,742	1,098	57	11·60
South-Eastern Rajputana, Central India, and Gujarat.	6,097	1,315	73	20·01
Deccan	10,262	1,090	66	8·97
Western Coast	1,672	900	61	8·37
Southern India	3,573	1,093	74	9·80
Hill Stations	9,921	744	49	8·87
Hill Convalescent Depôts and Sanitaria ...	3,673	1,027	69	10·89

Of the above 12 groups, nine returned a higher daily sick-rate than that for the European Army as a whole, and in five groups the death-rate was greater. The most unhealthy groups, judged by the daily sick-rate, were Burma Coast, Bengal and Orissa, Southern India and Central India, with daily sick-rates of 103, 76, 74, and 73 per 1,000 respectively.

Of the stations with a strength of over 1,000, the highest death-rates were those of Peshawar (22·15), Meerut (19·65), Ranikhet (19·06), Umballa (18·95), Sialkot (18·41), Mhow (17·94), and Fort William (13·70).

Cholera.—Cholera was very prevalent during the year, and among the European troops 81 cases were recorded with 57 deaths, against only three cases which proved fatal in 1902. All the Commands except Madras were affected but the deaths were reported from only 16 stations.

Small-pox.—Among the whole of the European troops in India there were during the year under notice 68 cases of small-pox with eight deaths. In the previous year there were 23 cases and four deaths.

Fevers.—From intermittent fever the admission-rate per 1,000 among the European troops was slightly less than in 1902, viz., 243 against 247, and the death-rate fell from 0·50 in 1902 to 0·34 per 1,000. How far this slight improvement is due to the measures taken for the destruction of infection-bearing mosquitoes is uncertain. The Sanitary Commissioner, however, says : "There can be no doubt that the efforts put forth during the past year have been far more general, more complete, more consistently and energetically maintained, and better organized than heretofore. At the same time signs are not wanting that in many respects the work has yet to be developed in its range and in completeness before we can hope for measurable results."

Enteric fever was more prevalent than in the previous year. The admissions rose from 1,012 or 16·7 per 1,000 of strength to 1,384 or 19·6, and the deaths from 260 to 295, but the death-rate fell slightly from 4·29 to 4·19 ; "the case mortality was lower to the extent that in every 1,000 cases 43 more men recovered in 1903 than in the previous year." Of the Commands Bombay again recorded the highest mortality under this head, viz., 4·63, followed by the Punjab and Bengal with ratios

of 4·39 each. Among the larger stations with an average strength of over 1,000, Meerut returned a death-rate from this fever of 11·59, Sialkot 10·04, Peshawar 9·85, Umballa 9·79, Poona 8·07, Mhow 7·69, Agra 5·43, Lucknow 4·81, Rawalpindi 4·69, and Ranikhet 3·31. As usual, young and unacclimatised soldiers were the chief sufferers; among those from 20 to 25 years of age the death-rate was 6·37 per 1,000 against 7·06 in 1902, while among men between 25 and 30 and from 30 to 35 the mortality was 2·58 and 1·45 per 1,000 respectively. Among men of less than one year's residence in India the death-rate from this fever was 7·95 per 1,000, among men between one and two years 4·88, and among men between five and ten years' service 3·28 per 1,000. Of the total 295 deaths from enteric fever, 74 per cent. occurred among men between the ages of 20–25, and 21 per cent. among men between the ages of 25–30.

Bowel Complaints.—The admissions from dysentery and diarrhœa among the European troops were in the ratio of 30 per 1,000 of strength, or 3 per 1,000 less than in 1902. The mortality from dysentery was in the ratio of 0·70 against 0·69 in the previous year. As regards the Commands the highest place is usually occupied by the Bengal Command, but in 1903 Burma district returned the highest admission-rate from dysentery.

Abscess of the Liver.—From abscess of the liver there were 92 deaths, giving a ratio of 1·29 per 1,000 of strength, against 112 or 1·85 in 1902.

Plague.—There were 12 cases of plague among the European troops and two deaths, against four cases and one death in 1902. The disease was prevalent among the general public in every Command area, but it was only in those of Madras and Bombay that the troops were attacked.

Venereal Diseases.—Venereal diseases ranked first in the list of causes of admission to hospital, and first in the causes of invaliding. They were the cause of nearly 24 per cent. of the total sickness during 1903, and of $10\frac{1}{4}$ per cent. of the invaliding of the European Army of India. The admission-rate from venereal diseases per 1,000 of strength was 247·0, a lower rate than had been recorded for 24 years, and less than half the maximum rate of 522·3 recorded in 1895. Of the Commands, Burma district returned the highest ratio, viz., 346·2 followed by Madras 334·7 against 343·4 in 1902; Bombay 259·6 against 286·7; Bengal 251·1 against 299·4; and the Punjab 176·1 against 217·5. The number of men constantly sick in hospital from these diseases was 1,569 against 1,431 in the previous year; and the average stay of a case in hospital was about 33 days. The deaths from these diseases numbered 10 and the invalidings 213, against 15 and 310 respectively in 1902.

Invaliding.—The loss to the whole European Army by invaliding during 1903 amounted to 2,063 men, equal to 29·29 per 1,000 of strength, against 2,255 or 37·25 in 1902. By Commands the invaliding rates ranged from 34·45 in Madras to 25·39 in the Punjab and there was a reduction in each as compared with the previous year. As regards the influence of age and length of residence in India upon invaliding, 50 per cent. of the total number invalided were under 25 years of age against 35 per cent. in 1902, while 30 per cent. against 17 were of less than two years' service, and 64 per cent. against 48 were of less than five years' service.

II.—NATIVE ARMY.

Sickness and Mortality in 1903.—The health of the Native Army of India during 1903 was exceptionally good. The admission and constantly sick rates were the lowest on record, and the death-rate was lower than in any previous year, if the mortality among men absent on furlough and sick leave be disregarded.

The ratios of sickness and mortality among Native troops in the Commands during 1903 and the previous year are given in the following table :—

Commands.		Average Strength.	Ratio per 1,000 of Average Strength.		
			Admissions.	Daily Sick.	Deaths.
Bengal	1903	29,338	615	22	8·21
	1902	26,652	629	25	8·03
Punjab	1903	40,582	692	26	10·60
	1902	43,486	746	27	12·76
Madras	1903	18,679	484	21	7·33
	1902	18,359	567	24	13·89
Burma District	1903	6,502	730	25	7·54
	1902	5,862	937	30	6·14
Bombay	1903	25,471	757	29	13·47
	1902	24,371	856	30	11·65
INDIA	1903	124,660	662	25	10·04
	1902	124,231	718	27	11·16

Of the Commands, Bombay was the most unhealthy in 1903, followed by the Punjab. Pneumonia continued very prevalent in the Punjab and Bombay Commands, and the death-rates from it were 4·41 and 4·20 per 1,000 respectively.

The chief cause of sickness in the Native Army was ague, which contributed 37 per cent. of the total admissions. Compared with the previous year there was some increase in the admission-rates from influenza, cholera, enteric fever, and tubercle of the lungs, and in the death-rates from cholera and enteric fever, but there was a diminished prevalence of all the other chief causes of sickness and mortality. From cholera the admission-rate rose from 0·2 per 1,000 of average strength in 1902 to 1·1, and from enteric fever from 0·4 to 0·6. From venereal disease the admission-rate was 24·5, against 247·0 among European troops.

Pneumonia was as usual the chief cause of death in the Native Army, and contributed 30·5 per cent. of the total deaths, the death-rate being 3·06 per 1,000 of average strength, against 3·71 in 1902. From this disease the mortality among the Native soldiers was more than five times as great as that among European troops (0·57 per 1,000). From fevers of all kinds the death-rate was 1·77 per 1,000, against 4·68 per 1,000 among the European troops. From ague, remittent and simple continued fevers the deaths among the Native troops were in the ratio of 1·55 per 1,000, while among the European troops the proportion was 0·75. On the other hand, the death-rate from enteric fever among the Native troops was only 0·22 per 1,000, as compared with 4·19 among the European troops.

From cholera there were 80 deaths in the Native Army, equal to 0·64 per 1,000 of strength, as compared with 15 or 0·12 in 1902.

During 1903 there were 184 cases of plague among the Native troops with 115 deaths, against 192 cases and 95 deaths in 1902.

Groups of stations.—The following statement gives the principal statistics of the Native Army, arranged in geographical groups, for 1903 :—

Groups.	Average Strength.	Ratio per 1,000 of Average Strength.		
		Admissions.	Daily Sick.	Deaths.
Burma Coast and Bay Islands	1,254	806	24	7·18
Burma, Inland	4,133	771	27	7·98
Assam	1,340	827	33	9·70
Bengal and Orissa	2,474	759	26	4·85
Gangetic Plain and Chutia-Nagpur	6,857	490	21	8·02
Upper Sub-Himalayan	15,987	575	21	12·76
North-Western Frontier, Indus Valley, and North-Western Rajputana.	17,283	788	28	10·13
South-Eastern Rajputana, Central India, and Gujarat.	12,202	829	29	10·74
Deccan	16,596	576	21	7·83
Western Coast	2,047	701	33	12·70
Southern India	7,170	591	28	7·53
Hill Stations	21,676	760	34	13·06

In six of the 12 groups the daily sick-rate was higher than that for the whole Native Army, and in three the mortality was greater. The highest mortality was recorded by the Hill Stations group, viz., 13·06, of which pneumonia contributed 4·71. In 1902 this group returned a death-rate of 13·70.

There were only two stations with an average strength of over 1,000 in 1903, viz., Mian Mir and Ferozepore, and their death-rates were 29·17 and 22·97 respectively. At the former station just over one-half of the mortality was due to cholera and a quarter to pneumonia ; and at Ferozepore one-third of the death-rate was due to pneumonia.

III.—GENERAL POPULATION.

The climatic conditions of the year 1903 were generally favourable ; the harvests were on the whole good, and food prices were slightly lower than in 1902 ; but the health of the people was less satisfactory, chiefly owing to the prevalence of cholera and plague.

The mean birth-rate of the population under registration was 38·96 per 1,000, against 39·38 in 1902, the birth-rates of the several provinces ranging from 46·13 per 1,000 of population in the United Provinces to 26·51 in Coorg. The mean death-rate for the whole of India was 34·7 per 1,000 against 31·49 in the previous year, the death-rates ranging in the various provinces from 49·0 in the Punjab to 22·2 in Madras Presidency. Of the chief diseases cholera was more prevalent, and the deaths rose from 224,135 in 1902 to 312,854. Coorg and Ajmer Merwara were quite free from the disease ; but in all the other provinces except Madras and Assam the mortality was higher than in the previous year. The mortality from small-pox, which had been steadily rising, fell from 115,603 to 93,693. From fevers the number of deaths was higher than in 1902 by 167,285, the total being 4,459,237 or 56 per cent. of the total deaths. Deaths from dysentery and diarrhœa rose from 236,869 to 273,459. The year 1903 was the eighth of the present epidemic of plague in India, and in each year except 1900, there has been a steady rise in the mortality from the disease. A further increase of 256,601 deaths occurred in the year under notice, the total being 701,894. Of these 281,269 occurred in Bombay, 215,462 in the Punjab, 84,499 in the United Provinces, and 65,680 in Bengal.

The deaths from the chief diseases and from all causes in the several British provinces were as follows :—

PROVINCES.	CHOLERA.		SMALL-POX.		FEVERS.		DYSENTERY AND DIARRHŒA.		PLAGUE.		DEATHS FROM ALL CAUSES.		
	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	
												1902.	1903.
Bengal	203,405	2·73	30,459	0·40	1,654,941	22·23	56,639	0·76	65,680	0·88	2,481,149	33·43	33·33
United Provinces of Agra and Oudh.	47,159	0·99	21,950	0·46	1,318,519	27·65	40,660	0·85	84,499	1·77	1,920,903	32·54	40·28
Punjab	14,688	0·73	15,635	0·78	509,307	25·33	16,498	0·82	205,462	10·22	985,476	44·11	49·01
North-West Frontier Province.	1,354	0·68	2,694	1·35	42,549	21·37	553	0·28	49	—	56,539	24·43	28·40
Central Provinces and Berar.	437	0·03	2,130	0·17	190,707	15·27	33,181	2·66	51,514	4·13	443,697	27·33	35·52
Lower Burma ..	5,346	0·97	1,266	0·23	55,788	10·14	8,863	1·61	9	—	132,767	21·16	24·13
Upper Burma ..	2,887	1·00	654	0·23	22,030	7·63	1,125	0·39	—	—	62,941	17·30	21·80
Coorg	—	—	43	0·24	4,770	26·41	137	0·76	45	0·25	5,676	27·06	31·43
Assam	8,360	1·58	1,111	0·21	75,004	14·22	10,516	1·99	28	0·01	140,069	29·01	26·55
Madras	27,393	0·7	15,015	0·4	314,926	8·4	49,389	1·3	13,291	0·4	826,663	20·2	22·2
Bombay	1,825	0·09	2,732	0·15	259,704	14·05	55,443	3·00	281,269	15·22	811,525	39·04	43·91
Ajmer Merwara ..	—	—	4	0·01	10,992	23·05	455	0·95	48	0·10	13,720	32·86	28·77
Total ..	312,854	1·37	93,693	0·41	4,459,237	19·66	273,459	1·21	701,894	3·03	7,881,125	31·49	34·7

Bengal.

The year 1903 was not generally a healthy one in Bengal. The birth-rate per 1,000 of population fell from 40·14 in the previous year to 39·00, which was made up of district ratios ranging from 50·91 in Gaza to 15·54 in Calcutta. Only in 20 districts did the birth-rate exceed 40 per 1,000, and it was lower in 31 districts and higher in 15 as compared with the previous year. In spite of an increase in deaths from cholera and plague, there was a slight falling off in the total mortality (from 2,488,428 to 2,481,149), and the death-rate remained nearly the same, viz., 33·33 against 33·43. Among the districts the highest rate (48·73) was recorded by Saran, and in 23 other districts out of 45 the provincial rate was exceeded.

Taking the chief diseases seriatim, there was a serious rise in the mortality from cholera, the number of deaths being 203,405 or 2·73 per 1,000, against 150,971 or 2·02 in 1902. The disease was present in every district, and it attacked over 13 per cent. of the villages against 11 per cent. in the previous year. Among other precautionary measures the disinfection of wells was resorted to in 25 districts which more or less suffered from cholera, and it is generally said to have been attended with beneficial results, although in Puri, where the wells were disinfected before the commencement of the cholera season, the second highest death-rate (6·31) from the disease among all the districts was recorded. Champaran district in the Patna division was the worst sufferer, the death-rate being 7·69.

Small-pox greatly abated during the year, and the deaths fell from 57,430 or 0·77 per 1,000 to 30,459 or 0·40. But though the mortality was smaller than in the two preceding years it was still very large, and energetic measures are being taken to push on vaccination as much as possible. The disease was present in all the districts except Chittagong, but the death-rate only exceeded 1 per 1,000 in three districts, the highest being 1·64 in Sonthal Parganas in the Bhagalpur division. Out of the total small-pox deaths over 61 per cent. occurred amongst children under ten years of age.

Fever was less prevalent than in the preceding year, the mortality from it amounting to 1,654,941 or 22·23 per 1,000, against 1,721,921 or 23·13 in 1902. As regards the relative intensity of the disease in each district, Dinajpur suffered most with a ratio of 37·19 per 1,000 against 37·09 in the preceding year, and in 22 other districts the provincial death-rate was exceeded. Steps were taken for the organization by private enterprise of agencies for the destruction of mosquitoes, but little was done in this respect. "The people generally," the Lieutenant-Governor says, "even those who are educated, including Europeans and many medical officers, do not yet appear to have grasped the importance of this measure." There was a large reduction in the number of packets of quinine sold during the year, which was probably due to the prevalence of fever being somewhat less than in the previous year.

Dysentery and diarrhœa were slightly less prevalent, but the death-rate (0·76) remained the same. As compared with the previous year the incidence of these diseases was lighter in 29 and heavier in 17 districts. The urban mortality was much greater than that in rural areas, and must, the Sanitary Commissioner fears, continue to be so while overcrowding with its attendant evils is allowed to exist.

Nearly twice as many deaths were recorded from plague as in 1902, the number having risen from 32,967, equal to a ratio of 0·44 per 1,000 of population, to 65,680 or 0·88. The disease was present in 29 districts against 24, Saran being the worst sufferer with a death-rate of 10·61, followed by Calcutta 9·69, Patna 7·19, and Shahabad 3·87, against 5·68, 8·58, 1·71, and 1·16 respectively in the preceding year. The measures adopted in dealing with the disease were disinfection and evacuation, but generally the attitude of the people towards the disease was one of marked apathy.

The municipality of Calcutta recorded a birth-rate of 15·5 per 1,000 of population, which is an improvement on the previous year's rate of 14·2, but still far below the actual facts. With a view to improving birth registration a new system was experimentally adopted in one district of the town, and the result showed an increase of 51 per cent. above the average of the past three years. It is proposed to extend the system to the other districts. The death-rate fell from 37·0 to 35·1. Excluding plague deaths this ratio is reduced to 25·4. Cholera was very prevalent in the first half of the year, but the year's mortality was somewhat below the average. The mortality from small-pox was comparatively low, as was also that recorded under fevers.

United Provinces of Agra and Oudh.

The year under notice was an unhealthy one in the United Provinces of Agra and Oudh. A birth-rate of 46·13 was recorded, which was the highest among the provinces of India, and exceeded the death-rate by 5·85 per 1,000. In 25 districts the birth-rate was above, and in 23 below, the provincial mean, the highest being 56·08 in Shahjahanpur, while ten other districts returned rates of over 50 per 1,000. The number of registered deaths rose from 1,552,046 or 32·54 in 1902 to 1,920,903 or 40·28, which was composed of district rates varying from 55·90 in Hamirpur to 30·94 in Mirzapur. Fevers, measles, and plague were the chief causes of the increased mortality. The last-named disease was exceptionally virulent and accounted for more deaths than plague.

Under all heads of disease the mortality was higher than in the previous year. Cholera deaths rose from 25,160 or 0·53 per 1,000 to 47,159 or 0·99. The increase was mainly due to an outbreak of the disease at the time of the dispersion of the pilgrims at the great fair (Kumbh Mela) at Hardwar. During the period of the fair only 11 cases of

cholera occurred. On the 13th of April, the great bathing day, some 400,000 people were present, and by the 16th about three-fourths had dispersed and the general sanitary arrangements were being broken up. On this day, it is reported, the disease broke out with great virulence among the Bairagis, a sect of fakirs, and from them it spread to other pilgrims still remaining in and about Hardwar, who carried it to other parts of the United Provinces and to the Punjab.

From small-pox the deaths rose from 4,976 or 0·10 per 1,000 in 1902 to 21,950 or 0·46. The districts which suffered most are situated in Oudh, where vaccination has hitherto been more backward than in other parts of the provinces. Of the total small-pox deaths over 88 per cent. occurred among children under ten years of age.

The deaths attributed to fever rose from 1,169,102 or 24·51 per 1,000 to 1,318,519 or 27·65. In many localities attempts have been made by civil surgeons to encourage the destruction of mosquitoes and their larvæ by the addition of kerosene oil to stagnant pools of water, and increased efforts were being made to improve surface drainage and to bring quinine more generally within the reach of the poorer classes.

The number of deaths recorded under dysentery and diarrhœa rose from 27,915 or 0·58 per 1,000 in 1902 to 40,660 or 0·85. As usual Garhwal headed the districts with a death-rate of 10·02, and in 15 other districts the provincial rate was exceeded.

The mortality from plague was more than twice as great as in the previous year, the total being 84,499 or 1·77 per 1,000 as compared with 40,223 or 0·84 in 1902. Deaths from the disease were reported from all but seven of the 48 districts. The highest rates recorded in the districts were 11·10 in Cawnpore, 9·07 in Allahabad, 6·69 in Lucknow, 6·19 in Ballia, and 6·04 in Unao, while in ten districts the number of fatal cases was below ten.

Punjab.

The Punjab was the unhealthiest province in India in 1903. The vital statistics of the province were vitiated to a considerable extent by the effects of plague. The birth-rate was 42·9 per 1,000 of population, which is only a fraction less than that recorded in the previous year. According to districts the birth-rates ranged from 50·1 in Sialkot to 17·3 in Simla. The death-rate was 49·0, and exceeded the rate of the previous year by 4·9 per 1,000. Among the districts Gujranwala had the highest death-rate of 96·3 per 1,000, of which more than two-thirds were due to plague. Nine other districts recorded death-rates of over 50 per 1,000, and in each of these plague was very virulent.

Almost every disease showed an increased mortality rate. In the two previous years the province was almost free from cholera, but in 1903 the disease prevailed in epidemic form and claimed 14,688 victims, equal to 0·73 per 1,000 of population. The province was free from the disease during the first three months of the year. In April, however, after the Hardwar Fair in the United Provinces, cases began to occur in different parts of the province among pilgrims returning from the fair, and the epidemic reached its height in July, when a mortality of 6,184 was registered. The disease declined considerably in the following months, until in December there were only two deaths from it. The total mortality was small compared with previous Kumbh fairs at Hardwar, a result which the Lieutenant-Governor says, "appears to have been largely due to the prompt and effective measures adopted by the district staffs of the province to cope with and obviate a spread of the disease." The districts of Ferozepore, Lahore, Ludhiana and Umballa were most affected, and contributed 62 per cent. of the total cholera mortality.

The mortality from small-pox was 15,635 or 0·78 per 1,000, being a fraction higher than the rate recorded for the previous year. The disease was present in all the districts. Rawalpindi was the chief sufferer with a death-rate of 2·95 per 1,000, and Kangra which is the best vaccinated district had as usual the lowest rate. Of the total small-pox deaths 80 per cent. occurred among children under ten years of age.

From fevers the death-rate rose to 25·33, being 1·78 higher than in 1902. Fourteen districts recorded a mortality in excess of the provincial rate, and in several of these the high mortality was attributed to unusual rainfall and heavy inundations. As yet little has been done in the destruction of mosquitoes. Trial measures were carried out in Gujranwala and Gujrat districts, but the severe prevalence of plague in the former interfered with the operations. Quinine was as usual distributed gratuitously in many of the districts.

The mortality from dysentery and diarrhœa rose slightly, from 0·70 per 1,000 in 1902 to 0·82, a ratio which was exceeded in nine districts, the highest being 2·11 in Umballa.

Plague spread considerably during the year, and in some of the most fertile districts the havoc played by the disease is stated to have been terrible. The deaths rose from 171,302 or 8·52 per 1,000 to 205,462 or 10·22. Among districts Gujranwala lost 63 per 1,000 of its population from the disease, Jullundur 28·6, Amritsar 25·6, Lahore 20·7. It is reported that 327,357 inoculations were performed during the year, and that, although the results varied in different areas, in the province as a whole the liability of the uninoculated to death was two and a half times greater then the liability of the inoculated.

North-West Frontier Province.

In the North-West Frontier Province the birth-rate fell to 31·6 from 33·6 in 1902, and the district rates ranged from 56·2 in Dera Ismail Khan to 29·7 in Peshawar. The deaths increased by 7,915, and the death-rate rose from 24·4 to 28·4. The year 1903 cannot therefore be considered a healthy one.

From nearly all the chief diseases the mortality was greater than in the previous year. In 1902 the province was entirely free from cholera, but in the year under notice 1,354 deaths from the disease were recorded, being equal to a ratio of 0·68 per 1,000 of population. The epidemic is said to have been traceable to the importation of cases from the Khumb Mela at Hardwar, in the United Provinces. From small-pox the death-rate rose from 0·54 to 1·35 per 1,000. Of the total 2,694 deaths from the disease, 2,500 were children under ten years of age. The death-rate from fevers was 2·45 per 1,000 higher than in 1903, and that from dysentery and diarrhœa slightly lower. There was very little plague in the province, the number of deaths being only 49 against 4 in the previous year, and all these occurred in the Hazara district.

Burma.

In Lower Burma the birth-rate in 1903 was 33·54 per 1,000 against 31·57 in the preceding year, the improvement in registration being attributed to the closer supervision now being exercised by the health officer and his assistants. In Upper Burma the registration of births is still confined to a few towns, and the average birth-rate was 37·48 against 38·07 in 1902. In both parts of the province there was an increased mortality which was ascribed to the unhealthiness of the year owing to abnormally heavy rains following a prolonged drought. In Lower Burma the death-rate rose from 21·16 to 24·13, and in Upper Burma from 17·29 to 21·80 per 1,000, the increases being mainly due to fevers and bowel complaints.

Cholera was very prevalent during the year. In Lower Burma the death-rate rose from 0·33 to 0·97, and in Upper Burma from 0·02 to 1·00 per 1,000. The disease prevailed in every district except Tavoy, and Mergui was practically free, as only three deaths were recorded. It was most severe in Akyab, where the death-rate reached 3·07 per 1,000.

Small-pox was the only one of the chief diseases which was less fatal than in the previous year. The death-rate was 0·23 per 1,000 in both parts of the province. Of the total 1,920 deaths 42 per cent. were children under ten years of age.

Fever as usual was the chief death cause of the province. In Lower Burma the deaths were in the proportion of 10·14 per 1,000 against 8·80 in 1902, and in Upper Burma 7·63 against 6·37. The Sanitary Commissioner attributed the increase to "the enhanced rainfall and consequent greater humidity of the atmosphere, the more extended water logging of the soil, and the increased rain-water lodgments on the surface." In the matter of the prevention of fever no systematic measures were carried out generally for the destruction of mosquitoes, but municipalities utilised their conservancy establishments in filling in pits and draining unnecessary collections of water.

The death-rate from dysentery and diarrhœa in Lower Burma was 1·61 per 1,000 against 1·30 in 1902, and in Upper Burma 0·39 against 0·23.

There was no case of indigenous plague during the year, but there were ten cases of imported plague, five of which were detected in the port of Rangoon, one in the town of Rangoon, and four at Moulmeim. Precautionary measures were taken to prevent the disease spreading and "the successful resistance to the invasion of plague from infected centres justifies," the Sanitary Commissioner states, "the stringency with which the rules in force have been worked."

Central Provinces and Berar.

Berar having been amalgamated with the Central Provinces since October, 1903, the vital statistics of the provinces are now treated together. For the year under notice the combined birth-rate was 45·11 per 1,000 of population against 50·17 in 1902. All the districts but two registered a lower birth-rate than in the previous year. On the other

hand the death-rate was higher, which was to some extent due to plague, though apart from this disease the year was not so healthy as 1902. The total deaths numbered 443,697 or 35·52 per 1,000 against 341,430 or 27·33. The increase was very general, being spread over all the districts but three in the Central Provinces.

The number of deaths recorded from cholera was 437, equal to a ratio of 0·03 per 1,000, against 44 or ·003 in 1902. There were two outbreaks of the disease, one at Kutni-Murwara, causing 143 deaths, and another which started in Wun and spread to Chanda district, causing 189 deaths.

The mortality from small-pox was considerably less than in 1902, the number of deaths having fallen from 4,621 or 0·37 per 1,000 to 2,130 or 0·17. The Sanitary Commissioner states that the district reports show that a number of the deaths attributed to measles and chicken-pox were probably due to small-pox. Of the total 2,130 deaths 73 per cent. occurred among children under ten years of age.

Fevers were more prevalent and fatal than in the previous year, and the deaths rose from 179,242 or 13·36 per 1,000 to 190,707 or 15·27. The increase, however, was entirely in the Central Provinces, as Berar registered 5,862 fewer deaths than in 1902. The Sanitary Commissioner states that with few exceptions the districts in the Central Provinces in which plague prevailed recorded an increase of fever mortality, but in the Berar districts in which plague prevailed there was a considerable decrease in fever mortality. Little was done during the year in the way of anti-malaria crusades, as the time of the Civil Surgeons was fully taken up with plague.

The death-rate from dysentery and diarrhœa rose from 1·69 per 1,000 to 2·66, the increase being attributed to the heavy rainfall of the year following a long dry season, thus rendering the people liable to these forms of bowel disease.

Plague was prevalent in many parts of the province during the year, and the deaths rose from 5,249 to 51,514 or 4·13 per 1,000. There were two epidemics, one in the earlier and another in the later months of the year. The disease raged with special violence in the districts of Nagpur, Jubbulpore, Hoshangabad, Nimar Narsinghpur, Amraoti, Akola and Buldana. The attitude of the people with regard to plague is reported to have undergone a change for the better; they understand the value of evacuation and the desirability of temporarily excluding arrivals from affected areas, but inoculation and disinfection are said to be unpopular.

Assam.

The general health of the population of Assam was better than in 1902. In the area under registration with a population of 5¼ millions the births represented a ratio of 35·57 per 1,000, which is a small improvement on 34·21 in the previous year. As usual Goalpara district had the highest birth-rate (43·22), followed by Sylhet, these being the only two districts in which the provincial rate was exceeded. The registered death-rate was 26·55 against 29·01 in 1902, the district rates ranging between 38·10 in Darrang and 18·22 in Lakhimpur. Darrang was the only district in which the death-rate was higher than the birth-rate.

From all the chief diseases there was a decrease in mortality. Deaths from cholera fell from 12,658 or 2·40 per 1,000 to 8,360 or 1·58. This, however, was the highest rate of all the provinces except Bengal. The diminished mortality was almost exclusively confined to the districts of Cachar and Sylhet in the Surma Valley, but only in the district of Nowgong was the mortality excessive (6·73).

The mortality from small-pox was unusually low, giving a rate of only 0·21 per 1,000 against 1·26 in 1902. The disease was most prevalent in the Cachar and Nowgong districts, and though the former returned the highest ratio in the province, its mortality was much below that of the previous year. Sixty per cent. of the small-pox deaths occurred among children under ten years of age.

The death-rate from fevers, including *kala azar*, was 14·22 per 1,000 against 14·72 in the preceding year, the mortality being highest in the Goalpara and Darrang districts. From *kala azar* 5,033 deaths were recorded, of which Darrang district contributed more than a half (2,657). There has been a steady decrease in the mortality under this heading since 1897, in which year there were 18,597 deaths from the disease.

From dysentery and diarrhœa the death-rate fell to 1·99 from 2·13 in 1902. Of the individual districts the mortality was highest in Lakhimpur and Sibsagar, in which the tea garden population bears a higher proportion to the total than in other districts of the Assam Valley.

Plague visited the province during the year for the first time and caused 28 deaths, the outbreak lasting from the 16th of May to the 3rd of July. Energetic

measures were taken for dealing with the outbreak and there was no opposition on the part of the people.

In the Madras Presidency the year 1903, like its predecessor, was one of abundant rainfall and reduced food prices, and was marked by a further increase in the birth-rate from 28·2 per 1,000 in the previous year to 31·2; the district rates ranged from 39·2 in Chingleput to 23·3 in Madura. The mortality was higher by 94,226, the total number of registered deaths being 826,663, or 22·2 per 1,000 against 20·2 in 1902. In the districts the death-rates ranged from 37·9 in Madras to 14·6 in Ganjam. Thirteen of the 22 districts registered a death-rate in excess of the Presidency rate. Madras.

The number of deaths recorded as due to cholera was 27,393, giving a ratio of 0·7 per 1,000 of population, against 29,769 or 0·8 in the preceding year. Three districts were free from the disease and in the remainder the mortality ranged from 6,157 or 2·2 in Malabar to one death in Bellary. The Government invited the attention of municipalities to the significant fact that in six municipal towns which had a protected water-supply the rate of mortality during the five years ending 1903 was lower by 66 per cent. than during the quinquennium preceding the introduction of the water-supply.

The death-rate from small-pox fell from 0·7 to 0·4 per 1,000 of population. The mortality was highest in the districts of North Arcot (1·1), Bellary (0·8), South Arcot (0·8), and Cuddapah (0·7). The municipalities were remarkably free from the disease; with a population of nearly two and a half millions, their death-rate was only 0·1 per 1,000, a fact which "goes to show that, in spite of possible frequent chances of importation, the influence of protection afforded by vaccination is demonstrable," vaccination being compulsory in all the municipalities. Over 74 per cent. of the small-pox deaths occurred among children under ten years of age.

Deaths ascribed to fever rose from 277,689 or 7·7 per 1,000 to 314,926 or 8·4, a much lower rate than that recorded in any other province excepting Burma. The Presidency rate was exceeded in 12 of the 22 districts, and the rates of these ranged from 15·8 to 8·6 per 1,000. With the view of exterminating malaria by the conjoint use of mosquito larvæ destruction, administration of quinine to human beings, and minor engineering works, the Madras Government has directed that funds should be allotted by local bodies for experiments in six carefully selected areas. "The officer selected for the duty," the Sanitary Commissioner remarks, "will work under this office and will have attached to him an intelligent engineering subordinate. There are here, therefore, the elements for a thoroughly honest trial of modern methods of dealing with malaria."

Dysentery and diarrhœa accounted for 12,756 more deaths than in the previous year, and the death-rate rose from 1·01 to 1·3, a rate which was exceeded in nine districts, the highest being 5·3 in Madras.

The number of deaths registered under plague was more than in the previous year by 2,496, the total being 13,291, representing a mortality of 0·4 per 1,000, which is not a high rate compared with the rates recorded by other provinces. The Sanitary Commissioner notices that during the year 1902–3 a sum of about £27,000 was expended by local fund boards and municipalities under plague charges. "So far as it is possible to gauge facts," he remarks, "it would seem that in restraining the advance of plague throughout the Presidency, the money demanded is well spent, and that trade and lives are husbanded."

The vital statistics of Bombay Presidency for the year 1903 disclose two notable features—a large and widespread increase in plague mortality and a large decrease in the birth-rate. The registered births numbered 576,949, or 54,444 less than in the previous year, and the birth-rate fell from 34·16 to 31·22. Among the districts, Ahmednagar registered the highest rate of 43·30, followed by Khandesh, 40·64, and Nasik, 40·16. As usual the lowest rate was recorded in the Sind district of Thar and Parkar (13·25). The mortality was the highest on record except that of the famine year 1900, the deaths numbering 811,525 or 43·91 per 1,000 against 721,462 or 39·04 in 1902. In nearly all the districts the death-rates were abnormally high, Belgaum and Dharwar, where plague was most severe, recording rates of over 70 per 1,000, and in nine other districts the rates ranged from 65·99 to 45·14. Bombay.

There was again comparatively little cholera in the Presidency during the year, only 1,825 deaths being recorded, which is the lowest mortality from the disease since the year 1886. The disease was practically confined to four districts in Sind, where 1,752 deaths occurred.

From small-pox there were only 2,732 deaths, and of these Bombay City contributed 1,460. In none of the other districts was the mortality high. Nearly 70 per cent. of the deaths occurred amongst children under ten years of age.

Deaths from fever were fewer by 11,141, the number having fallen from 270,845 or 14·66 per 1,000 of population in 1902 to 259,704 or 14·05. Of the districts Ahmedabad recorded the highest fever mortality (31·19); in 12 other districts the death-rates ranged from 24·83 to 14·16.

The deaths ascribed to dysentery and diarrhœa, which were so numerous during the famine years, notably in 1900, when the mortality was 218,243 or 11·59 per 1,000, fell to 55,443 or 3·0 in 1903.

The deaths from plague reached 281;269 or 15·22 per 1,000, an excess of 96,517 on the mortality of the previous year, and by far the largest number recorded in any province during the year. Nearly a third of the deaths (92,043) occurred in the two districts of Belgaum and Dharwar. Only two of the 25 districts of the Presidency were entirely free from the disease.

IV.—JAILS.

Sickness and mortality in 1903.

The health statistics of the jails of British India for 1903 show a further satisfactory improvement in the health of the prisoners. On the whole there was considerably less sickness, and the death-rate fell from 22·5 per 1,000 of average strength in the previous year to 19·5, which is the lowest rate on record. To this result all the provinces contributed except Madras and Burma, the decrease in mortality being most marked in Coorg, the Punjab, the United Provinces and the Central Provinces. The improvement is the more satisfactory "when it is remembered that the conditions of life, economic and hygienic, to which the majority of the free population have of recent years been subjected have been far from favourable, and that the main causes of sickness within the jails have remained unaltered, and have diminished only slightly and recently in the extent of their incidence." There were 57 deaths from cholera against 24 in 1902, and all other diseases which usually assume an epidemic form showed a diminution. Although plague was so widespread and fatal during the year there were only 23 deaths from the disease in the jails.

The following statement shows the sickness and mortality among all classes of prisoners in the jails and subsidiary jails of the various provinces for 1903 as compared with the previous year :—

Provinces.	1903.			1902.		
	Ratio per 1,000 of Average Strength.			Ratio per 1,000 of Average Strength.		
	Admissions.	Daily Sick.	Deaths.	Admissions.	Daily Sick.	Deaths.
Bengal	1,053	38	23·5	1,041	39	25·4
United Provinces of Agra and Oudh.	701	34	15·5	734	35	20·4
Punjab	939	30	19·2	1,137	35	25·0
North-West Frontier Province...	1,117	33	15·6	1,038	32	28·0
Burma	474	21	17·1	537	25	15·9
Central Provinces (including Berar).	816	27	18·2	930	29	23·5
Assam	783	32	28·1	857	39	29·9
Coorg	195	7	13·9	320	32	48·0
Madras	539	20	18·1	390	22	17·8
Bombay	529	22	25·8	682	28	28·2
India	755	29	19·5	793	32	22·5

Bengal.

The health of the jail population of Bengal during the year was generally good, and the death-rate among all classes of prisoners (23·5 per 1,000) was lower than in any of the previous ten years except 1898 and 1899. The jail death-rate was considerably below that of the whole population (33·4), which, as stated in last year's report, is satisfactory "considering that a large proportion of the jail population must always be drawn from those classes whose vitality is considerably below the normal standard." In four jails there were no deaths and the death-rates of the central jails, with three exceptions, were very low. The Barisal jail, however, was unhealthier even than in former years, and returned the high death-rate of 90·6 per 1,000. Vigorous steps have been taken to improve the drainage of this jail, to enlarge the site, to increase the accommodation of the building, and otherwise improve its sanitation. There were 24 cases of cholera among the prisoners 15 of which were fatal. There was a further diminution in prevalence of and mortality from dysentery, and one of the most satisfactory

features of the year is that 15 jails had no deaths from the disease. Next to dysentery, tubercle of the lungs, &c., and pneumonia were the most fatal diseases. In spite of the prevalence of plague in many districts the disease attacked only four jails, viz., Bankipore, Arrah, Chapra and Bahr subsidiary jail. They recorded 17 cases, with 12 deaths. In the previous year there were only four fatal cases among the prison population of Bengal.

United Provinces of Agra and Oudh.

The health of the prisoners in the United Provinces of Agra and Oudh was again exceptionally good during the year 1903. Among all classes of prisoners the daily average sick rate per 1,000 of average strength was 34 against 35 in the previous year, and the death-rate 15·5, which was the lowest on record. Of the 56 jails in the provinces there were no deaths in seven, and in 12 out of 32 in which the mortality was higher than the provincial average, the death-rate did not exceed 20 per 1,000. From all the chief disease causes there was less sickness and mortality than in the previous year. There was very little cholera among the prisoners, only 15 cases and 13 deaths having been recorded, and of these 12 cases and 10 deaths occurred in the Agra Central Prison. The epidemic in this jail was soon checked by the removal of the prisoners from the infected quarters into camp. Of other diseases, dysentery accounted for only 60 deaths against 133 in 1902, tubercle of the lungs, &c., 59 against 92, and pneumonia 51 against 61. The great reductiom in the mortality from dysentery was attributed to the excellent sanitary conditions under which the prisoners live, and to the care which is given to the purity of the jail water and food supplies. In the majority of the jails there is good accommodation for isolating and treating cases of dysentery and tubercle.

Punjab.

The health of the prisoners in the Punjab during 1903 was wonderfully good considering the prevalence of disease outside the jails. The ratio of constantly sick declined from 35 to 30 per 1,000, and, notwithstanding that there was a rise of 5 per 1,000 in the death-rate of the free population, the mortality of the jails decreased from 25·06 to 19·18—"a remarkable testimony to the sanitary condition of the jails, and this is made clearer when it is added that throughout the year the jail population has been practically immune from plague." Out of 30 jails, there were no deaths in three, and in eleven others the death-rate was well below the provincial average. Of the remaining 16 jails, the death-rate was higher than the provincial average in 10. Only eight cases of cholera with two deaths occurred in the jails, and all the other chief causes of sickness and mortality were less prevalent and fatal. In spite of the wide-spread prevalence of plague throughout the province, only one death from the disease occurred among the convict population, the immunity enjoyed by the jails being ascribable to the quarantine precautions taken and to the watchfulness exercised by medical officers.

North-West Frontier Province.

The general health of the prisoners in the North-West Frontier Province during 1903 was again satisfactory. With a small increase in the sick rate the death-rate fell from 28·02 to 15·6, which was 12·74 below that of the free population. Of the 19 who died, only 9 were admitted into jail in good health. Malaria as usual figured largely in the causation of disease, and it was specially prevalent at Dera Ismail Khan, owing to the "excessive summer rainfall and the consequent opportunity for the production of anopheles." There were no admissions to hospital for cholera or other epidemic disease during the year, although the former disease prevailed somewhat severely among the civil population.

Burma.

Among the prison population of Burma the admission and constantly sick rates were the lowest on record, but the death-rate rose from 15·88 per 1,000 in 1902 to 17·07. There were no deaths in five out of the 32 jails and in 14 others the mortality was below the provincial rate. The most unhealthy jail was at Mandalay, which recorded a death-rate of 30·13. Nearly half this mortality was due to dysentery, for which the water-supply was held responsible. This has been remedied by an artesian well, and a good and wholesome supply is now said to be obtained. Cholera accounted for seven deaths against nil in the previous year, and there was increased mortality from pneumonia, dysentery and diarrhœa, enteric fever, and anæmia and debility. On the other hand the admissions for tubercle declined from 113 to 84 and the deaths from 45 to 38. The isolation of these cases and their treatment in the open air received the special attention of the medical officers as heretofore.

Central Provinces and Berar.

The health of the prisoners in the Central Provinces and Berar jails greatly improved during 1903. There was no overcrowding to any considerable extent. There was considerably less sickness and the death-rate fell to 18·16 from 23·55 in 1902. Excepting a nominal increase at Jubbulpore and Akola there was a fall in all other jails in the daily average number sick, accompanied in nearly all jails by a remarkable decrease in the mortality. In ten out of the 25 jails there were no deaths. Malarial fevers were as usual the chief causes of sickness, while bowel diseases furnished the largest mortality, though there were only 15 deaths against 32 in the previous year. From tubercular diseases also the mortality was less. The construction of isolation wards in the three central jails of Nagpur, Jubbulpore and Raipur for the treatment of such cases was undertaken during the year. Although plague was epidemic in 12 headquarter towns, the disease failed to establish itself in any jail in the province. Only three cases occurred in the prisons, and of these one was fatal.

Assam.

Among the prisoners of Assam there was considerably less sickness than in the previous year, and the rate of mortality fell from 29·9 to 28·1. There was a marked decrease in the prevalence of malarial fevers, but an increase in cases of dysentery. The improvement was chiefly due to the exceptional healthiness of Sylhet jail, where the death-rate fell from 31·89 in 1902 to 21·74. In only four of the jails was the average strength over 100, and three of these (Tezpur, Gauhati, and Sylhet) contributed 33 out of the total of 41 deaths. In 14 jails no deaths took place. The mortality was excessively high at Tezpur, amounting to 66·71 per 1,000, of which 39·42 was due to dysentery.

Madras.

The general standard of health was well maintained throughout the year 1903 among the prisoners in the Madras Presidency. The death-rate was 18·1 per 1,000 against 17·8 in the previous year, while the ratio per 1,000 of daily average sick (19·8) was the lowest recorded during the past decade. The slight rise in mortality was due to cholera, which accounted for 11 deaths, seven of which occurred in Berhampur district jail. Of the seven central jails only in Trichinopoly did the mortality exceed 30 per 1,000, and there a death-rate of 31·10 was recorded, and two-thirds of the 23 deaths were persons admitted in bad or indifferent health. The number of admissions to hospitals and of deaths from tubercular diseases again declined. Tuberculous patients are treated separately; measures are taken for the disinfection and destruction of infective excreta; open air treatment is as far as possible enforced, and steps are being taken for the provision of special tubercle wards in the larger jails. There was only one fatal case of plague, and this was reported from the Vellore Central jail, the disease being epidemic in the town during the year.

Bombay.

The health of the prisoners in the Bombay Presidency during the year 1903 showed a general improvement. Overcrowding occurred in 7 out of the 15 jails, and was relieved by transfer, and by the use of tents, temporary sheds, &c. The daily average sick rate was less, and the death-rate fell from 28·2 to 25·8. There were no cases of cholera in any of the jails, and there were fewer admissions into hospital under all the other chief diseases, except pneumonia, a serious epidemic of the disease having occurred in the Sind gang, causing 33 deaths out of a total of 37. Admissions for malarial fever were much fewer. The decline was very noticeable in the Central Prison of Yeraoda, where the cases fell from 468 in 1902 to 66 in 1903, the decline being attributed to the distribution of quinine among the extra-mural gangs. Although plague was widely prevalent in the Presidency during the year, there were only 10 cases and 8 deaths from the disease in the jails.

V.—VACCINATION.

General results.

During 1903-04 there were 8,458,464 persons vaccinated in the several provinces of India, being an increase of 25,734 on the number of the previous year. The increase was spread over all the provinces except Bengal, Assam, Madras and Coorg, but in most cases it was limited to primary operations. According to age, 3,746,289 children under one year of age, and 3,234,617 children between the ages of one and six years were successfully vaccinated during the year. The proportion of population protected against small-pox by the year's operations ranged from 48·67 in Coorg to 24·63 in Bombay Presidency. In the vaccination of infants the best results were obtained in the Central Provinces and Berar, the Punjab, Ajmer-Merwara, United Provinces, the North-West Frontier Province.

Statement showing the total number of persons successfully vaccinated during the year 1903–04 :—

Province.	Population among whom Vaccination was carried on.	Number of Persons vaccinated.	Ratio of successful Vaccinations per 1,000 of Population.	Number of Children successfully vaccinated.		Percentage of Annual estimated Births at 40 per 1,000 of Population successfully vaccinated.
				Under One Year of Age.	Between One and Six Years of Age.	
Bengal	74,735,533	2,748,638	35·62	877,810	1,519,276	29·36
United Provinces of Agra and Oudh.	47,960,667	1,667,104	33·20	965,613	470,477	50·33
Punjab	20,293,834	685,105	31·15	472,669	99,624	58·23
North-West Frontier Province	2,092,713	99,176	43·10	41,315	21,211	49·36
Burma	10,477,508	412,564	32·36	79,650	182,157	19·00
Central Provinces and Berar...	14,627,045	646,305	41·07	390,452	123,627	66·73
Assam	6,126,343	278,802	44·28	64,415	182,076	26·29
Madras Presidency	38,408,531	1,309,985	30·00	423,584	544,825	27·57
Bombay Presidency	21,539,199	587,933	24·63	419,728	84,302	48·72
Coorg	180,607	9,653	48·67	840	4,599	11·63
Ajmer-Merwara	476,912	13,199	27·42	10,213	2,443	53·54
TOTAL	236,918,892	8,458,464	33·32	3,746,289	3,234,617	39·53

Bengal.

The results of vaccination work in the province of Bengal during the year 1903–4 show a decrease of 33,334 operations on the number for the previous year, and a fall in the proportion of persons successfully vaccinated from 37·21 per 1,000 to 35·62. The decrease, however, was entirely under re-vaccinations, due to the less prevalence of small-pox as compared with the previous year, and the consequent smaller number of re-vaccinations done in connection with the stamping out of small-pox epidemics. But the Local Government is of opinion that the Vaccination Department as at present constituted was unable to cope with the disease, and proposals for re-organising it and increasing the superior staff so as to secure adequate supervision were under consideration. Out of the 49 districts in the province, including the Tributary States of Orissa and Chota Nagpur, there was an increase of vaccinations in 28 and a decrease in 21. Of the total 2,634,563 primary vaccinations 212,537 were performed with calf lymph, 415,310 with lanoline lymph, and 2,006,716 by the arm to arm process, the ratio per cent. of success under each of these methods being 98·83, 97·01 and 98·35 respectively.

In Calcutta the vaccination returns showed a further decline, the total number of persons vaccinated (15,907) being 1,627 less than the number in the previous year (17,534). The Department was again remodelled towards the end of the year, and the change yielded improved results during the last quarter.

United Provinces of Agra and Oudh.

In spite of the continued increase of plague in the United Provinces of Agra and Oudh during the year 1903–4 the number of persons vaccinated rose to 1,667,104, an increase of 1,851 on the figures of 1902–3. There was an increase of 1,856 in the number of successful primary vaccinations. Of the 49 districts 28 recorded increases, the most conspicuous being Cawnpore and Sitapur with increases of 4,010 and 3,831 respectively. The percentage of successful primary cases in which the results were known was practically the same as last year, viz., 97·83 against 97·90. Bovine lymph was very little used, only 23,993 operations being performed with it, with a percentage of success of 97·77. The Vaccination Act is in force in all municipalities and cantonments, but the rules are said to be enforced with a varying degree of energy in different places.

Punjab.

There was an increase of 17,561 in the number of vaccinations performed in the Punjab during 1903–4, but it was entirely confined to primary operations as re-vaccinations showed a decrease of 4,017. Fifteen out of the 27 districts of the province recorded an increase and 12 a decrease of work. Of the 581,221 successful primary vaccinations, over 81 per cent. were infants under one year of age. The Vaccination Act was not extended to any new town during the year. Proposals were, however, under consideration for extending it to the towns of Rewari, Jalalpur and Mianwali. In the majority of the towns in which the Act is in force satisfactory work was done during the year. In certain towns no vaccination work was done on account of the severe prevalence of plague.

North-West Frontier Province.

Good progress was made in vaccination work in the North-West Frontier Province during 1903–4, the total number of operations being 99,176 or 8,883 more than the previous year's total. Of these 94,262 were primary cases with a percentage of success of 91·52. The increase was due to an extension of vaccination work in Chitral where on account of small-pox being epidemic, 28,353 vaccinations were performed. Of the total successful primary vaccinations, nearly 48 per cent. were infants under one year of age, and the number of persons successfully vaccinated per 1,000 of population was 43·10, against 39·85 in the previous year. Both animal and preserved vaseline lymph were used during the year, the former showing in primary cases a percentage of success of 93·14, and the latter of 79·86. Out of the ten municipal towns in the province, the Vaccination Act is in force only in three, viz., Dera Ismail Khan, Bannu and Kohat.

Burma.

The total number of vaccinations performed in Burma rose from 381,773 to 412,564 in 1903–4. The increase was pretty generally distributed except in the Mandalay division, in which there was a falling of in every district save Katha, and in the Chin Hills. Primary vaccinations rose from 355,013 to 385,102, but the percentage of success was lower than in the previous year, being 84·98 against 86·93. In municipalities where the Vaccination Act is in force 86·93 per cent. of the available infants were protected during the year, while in the province as a whole only 19 per cent. of the births estimated at 40 per 1,000 of the population were successfully vaccinated. But vaccination in Burma has much to contend against owing to the strong prejudice in favour of inoculation "and since personal infection is the governing factor in the spread of the disease, small-pox must always be more or less prevalent so long as inoculation continues, and epidemic exacerbations will occur periodically according to the epidemic constitution of the year."

Central Provinces and Berar.

The control of the Berar Vaccination Department was transferred to the Administrative Medical Officer, Central Provinces, at the close of the year under notice and the statistics of Berar are accordingly included in those of the Central Provinces. The aggregate number of vaccinations reached 646,305, the percentage of success in primary operations being 98·52 and in re-vaccinations 74·32. Compared with the previous year there was an increase of 41,190 operations mainly contributed by the Central Provinces as all the Berar districts except Akola showed a considerable decrease, which was in a great measure due to the epidemic of plague. During the year no new town either in Berar or in the Central Provinces came under the operation of the Vaccination Act, and even in the municipalities where the Act was already in force, vaccination work was somewhat back-

ward, only 17,769 children under one year of age being vaccinated out of an available total of 21,422.

Assam. The results of vaccination work in Assam during 1903–4 show a decrease of 25,319 operations as compared with the previous year. The decrease occurred in eight of the 13 districts. Inoculation is still carried on, and the question of taking measures to prohibit it in certain districts where it prevailed was under consideration. The percentage of successful primary operations was 97·87 or almost the same as in the previous year. Vaccination of children under one year of age decreased, only 26·29 per cent. of the number available being protected against 28·48 per cent. in the previous year. In towns where the Vaccination Act is in force a mean of nearly 70 per cent. of the children available for vaccination were protected, the figures varying between 85·71 in the Union of Golaghat and 39·41 in Gauhati. The amount and quality of the work done at the Animal Vaccine Depôt at Shillong was not so satisfactory and complaints were received regarding certain early supplies.

Madras. The total number of vaccinations performed in the Madras Presidency during 1903–4 was 1,309,985, a falling off of 22,224 cases as compared with the preceding year. The decrease was mainly in local fund areas, and was accounted for by deficient and irregular supply of lymph, absence of small-pox, and prevalence of plague and absence of vaccinators. The percentage of success remained stationary being 90·8 against 90·7 in the preceding year. A satisfactory feature of the year's work is an increase of 41,505 in the number of children under one year of age successfully vaccinated, but the total number represented only 27½ per cent. of the estimated births. Vaccination is compulsory in all the municipalities, and a ratio of 75 per cent. and upwards was attained by 41 towns against 38 in the preceding year. Of the various lymphs in use during the year calf to arm vaccination yielded the highest percentage of successful cases ; viz., 98·5, followed by 96·9 with animal lymph in tubes and plates.

Bombay. In the Bombay Presidency the number of vaccinations performed rose in the year under notice to 587,933, or 9,048 more than in 1902–3, a result which is very satisfactory "considering that it was achieved in spite of a severe plague epidemic and numerous changes in the supervising staff." Out of the total number of primary vaccinations 510,726 or 92·65 per cent. were successful. Exclusive of Native States and Aden, which are not under the supervision of the Vaccination Department, 363,038 infants, or 79·99 per cent. of the available infants were successfully vaccinated. Human lymph continues to be used in the vast majority of cases, and the percentage of success following its use is everywhere high. In the Southern Registration District vaccination with preserved lymph (lanoline paste) has met with great success and measures have been taken to facilitate its more extended use. A scheme for the establishment of a central depôt for the preparation of preserved lymph for the whole Presidency and Sind at Belgaum is stated to be under consideration.

No inoculation was reported to have been practised anywhere during the year, and no instances were reported of any disease having been communicated through vaccination.

I.—MEDICAL INSTITUTIONS.

Civil Hospitals and Dispensaries.

The following comparative statement shows the number of hospitals and dispensaries under official control open in the several provinces of India during 1903 and the previous year, and the number of patients under treatment :—

Provinces, &c.		Number of Institutions.	Number of In-door Patients.	Number of Out-door Patients.	Total Number of Patients.
Bengal	1903	597	50,673	4,360,682	4,411,355
	1902	574	52,237	4,110,539	4,162,776
Calcutta and Howrah	1903	17	27,178	260,910	288,088
	1902	17	29,063	260,769	289,832
United Provinces of Agra and Oudh	1903	375	53,437	3,553,217	3,606,654
	1902	368	55,212	3,677,116	3,732,328
Punjab	1903	252	54,686	3,260,640	3,315,326
	1902	251	50,138	2,968,988	3,019,126
North-West Frontier Province ...	1903	39	7,787	539,573	547,360
	1902	37	7,624	514,135	521,759
Burma	1903	134	47,934	931,260	979,194
	1902	129	42,168	883,246	925,414
Central Provinces and Berar	1903	153	12,089	1,548,338	1,560,427
	1902	151	15,371	1,712,141	1,727,512
Assam	1903	127	7,025	884,626	891,651
	1902	127	6,683	814,648	821,331
Coorg	1903	7	932	44,979	45,911
	1902	7	1,071	43,633	44,704
Madras	1903	483	60,382	4,913,260	4,973,642
	1902	485	61,592	4,929,053	4,990,645
Bombay	1903	316	50,734	2,101,865	2,152,599
	1902	312	51,621	2,124,846	2,176,467
TOTAL	1903	2,500	372,857	22,399,350	22,772,207
	1902	2,458	372,780	22,039,114	22,411,894

Bengal.

The number of dispensaries at work in Bengal outside Calcutta during 1903 was 23 in excess of that of the previous year, and the total number of patients treated rose by nearly a quarter of a million. But although there was a general increase in the attendance the number of in-patients decreased by 1,564 as compared with the figures of the previous year, due partly to an improvement in the public health. A satisfactory feature in the returns is the increased popularity of the dispensaries among female patients who numbered 41,251 more than in 1902. The attendance of children also increased by 55,293. There was an increase of patients under all the chief diseases except malarial fever, from which there was a decrease of 28,205 cases. The death-rate amongst the in-patients was 96·1 per 1,000, against 104·7 in 1902. The popularity of these institutions is further shown in the continuous increase in the number of operations which rose from 171,647 to 184,420 ; of these 213 were fatal. Among the more important operations there were 2,772 cases of cataract.

The following statement shows the number of in-door and out-door patients treated in the several hospitals and dispensaries in Calcutta and Howrah during 1903 and the previous year :—

NAME OF INSTITUTION.	1903.				1902.			
	In-door Patients.	Out-door Patients.	Total Number of Patients.	Died per 1,000 of In-door Patients treated.	In-door Patients.	Out-door Patients.	Total Number of Patients.	Died per 1,000 of In-door Patients treated.
Medical College Hospital	5,161	40,760	45,921	142·9	5,447	39,764	45,211	144·1
Eden Hospital	1,438	3,363	4,801	59·8	1,636	3,403	5,039	78·2
Ezra Hospital..	174	—	174	57·4	230	—	230	43·4
Shama Charan Law Eye Hospital	756	11,557	12,313	—	690	10,935	11,625	1·4
Presidency General Hospital	3,040	1,633	4,673	—	2,974	1,333	4,307	56·8
Campbell Hospital	7,584	24,963	32,547	234·4	7,844	25,844	33,688	256·6
Police Hospital	2,936	—	2,936	10·8	3,799	—	3,799	10·0
Mayo Native Hospital	2,091	25,611	27,702	153·5	2,128	26,069	28,197	138·6
Chandney Hospital	319	44,422	44,741	40·7	335	45,025	45,360	50·7
Park Street Dispensary	—	26,402	26,402	—	—	26,811	26,811	—
Chitpur Dispensary	—	18,528	18,528	—	—	17,981	17,981	—
Sukea Street Dispensary	—	15,590	15,590	—	—	15,254	15,254	—
Dufferin Victoria Hospital	648	6,604	7,252	—	634	6,452	7,086	26·8
Sambu Nath Pandit Hospital	1,183	19,833	21,016	103·1	1,269	19,767	21,036	140·2
Kidderpore Municipal Dispensary	—	5,641	5,641	—	—	5,737	5,737	—
„ Dockyard „	—	3,486	3,486	—	—	4,032	4,032	—
Howrah General Hospital	1,848	12,517	14,365	208·8	2,077	12,362	14,439	242·6
GRAND TOTAL	27,178	260,910	288,088	134 9	29,063	260,769	289,832	142·9

At the various medical institutions in Calcutta there was a decrease of 1,744 in the number of patients which was due to an improvement in the public health of the city. The decrease was confined to in-patients and was shared in by 9 out of the 12 institutions which accommodate this class of patients. The improvement of the public health is shown in the marked decrease in the number of malarial fever cases from 49,504 to 44,962. Diseases of the zymotic group were also less frequent, cases of cholera, small-pox, plague, enteric fever and cerebro-spinal fever having all diminished. Among the in-patients there were 3,669 deaths, giving a ratio of 134·9 against 142·9 in 1902. The total number of operations performed during the year was 29,473, against 28,385 in 1902, and deaths resulted in 225 cases against 200.

United Provinces of Agra and Oudh.

There was an increase of seven in the number of dispensaries at work in the United Provinces of Agra and Oudh during 1903, and a decrease of 125,674 in the number of patients, the falling off being due to the supply of medicine in larger quantities at one visit to out-patients, thereby lessening the daily attendance. Among the in-patients there were 2,849 deaths against 2,420, and the death-rate rose from 43·8 per 1,000 to 53·3. Of the diseases for which the patients were treated there were 2,493 cases of cholera, as compared with 1,069 in the previous year, and cases of malarial fever fell by 45,467. The number of surgical operations was 185,087, and of these 158,492 were successful and 453 were fatal. Among the operations, 5,172 were for cataract.

Punjab.

There was an increase of one in the number of hospitals and dispensaries at work in the Punjab during the year 1903, the total being 252. The attendance of both in-patients and out-patients exhibits an increase of 296,200 over that of the previous year, and the fact "that this marked rise occurred during a year in which plague was more severe than in any previous year seems to dispose effectually of the theory put forward in last year's Report that the prevalence of plague may account for diminished attendance owing to apprehension on the part of the people regarding the treatment they will be made to undergo." Of the total 3,315,326 patients under treatment during the year, 54,686 were in-patients, of whom 2,332, or 42·8 per 1,000, died, against a mortality of 2,385, or 47·5, in 1902. Of the total number of patients the largest increase occurred among those treated for malarial fevers (increase,

122,486 cases) and diseases of the eye and ear ailments (increase, 43,728 and 25,750 cases respectively). In the number of surgical operations performed (162,396) there was an increase of 9,348, which the Lieutenant-Governor considers an excellent record of work. Of the total operations 157,997 resulted in cure and 269 were fatal. There were 5,326 operations for cataract, and of these 4,841 were successful.

North-West Frontier Province.

The popularity of the dispensaries in the North-West Frontier Province was well maintained during the year 1903. Returns were received from 39 dispensaries, and at these 547,360 patients were treated, being an increase of 25,601 on the attendance in the previous year. Of the 7,787 in-patients, 5,925 were cured and 348 died. Cholera was responsible for 189 cases against only one in 1902. There was a marked increase in cases of malarial fever, Dera Ismail Khan being the chief contributor, the cases having risen by 9,811 over the figure for the previous year. The total number of operations performed was 23,026, or 1,236 more than in 1902. The results showed 22,553 cases as cured and 54 deaths.

Burma.

A total of 134 hospitals and dispensaries under Government supervision were working in Burma during 1903 or five more than in the previous year. At these 979,194 patients were treated, being an increase of 53,780 over the figures for 1902. Of the 47,934 in-door patients, 77 per cent. were returned as cured, and 2,675 or 56 per 1,000 died, as compared with a mortality of 63 per 1,000 in the previous year. As usual malarial fevers headed the list of diseases for which patients sought treatment, next in order being worms, ulcers, diseases of the eye, and diseases of the digestive system. Cholera was more prevalent, and the cases treated in the hospitals rose from 278 to 674. The number of surgical operations continued to increase, and in 1903 aggregated 23,086. Amongst the patients operated on 22,323 were cured and 89 were fatal.

Central Provinces and Berar.

During the year 1903 there were 153 hospitals and dispensaries at work in the Central Provinces and Berar, and at these 1,560,427 patients were under treatment, against 1,727,512 in the previous year, a decrease of 167,085. This decline in attendance had reference to both in-door and out-door patients, and was mainly due to evacuation of towns on account of plague. "As the epidemic progressed," it is reported, "the towns were practically deserted for considerable periods, the inhabitants were scattered over the neighbouring country, and even if they were eager to attend the hospital, were probably deterred from doing so through fear of approaching the centre of infection." As regards the number of patients treated for different diseases, the most important variation as compared with 1902, was a decrease of 72,323 in the number of fever cases, which was attributable more to the plague scare than to any decline in the prevalence of this disease. The number of surgical operations performed during the year totalled 38,352, and of these 37,585 were cured and 89 were fatal.

Assam.

In the province of Assam there were 127 dispensaries open during 1903, being the same number as in the previous year. In spite of the healthiness of the year there was a further large increase of 70,320 patients treated, which is an indication that the popularity of the dispensaries is increasing. The number of in-patients rose from 6,883 to 7,025, and of these 4,418 were cured and 759 died, giving a death-rate of 108·0 per 1,000 against 110·4 in 1902. Of the various diseases for which the patients were treated the largest numbers were under skin diseases and malarial fever. It is a satisfactory feature of the year that cholera cases declined from 2,571 to 1,768. The total number of operations rose from 17,417 to 18,150; but these were mostly of a trivial character, and only 790 were important.

Madras.

In 483 hospitals and dispensaries in the Madras Presidency 4,973,642 patients were under treatment during the year 1903, a decrease of 17,003 on the total of the previous year. The decrease was entirely amongst children, as both amongst men and women there was an increase. Of the 60,382 in-patients more than half were cured and 3,773 or 62·5 per 1,000 died, against a death-rate of 70·2 in 1902. Among the general diseases treated which formed 29·10 per cent. of the whole number the most important were malarial fevers, worms, and rheumatic affections. Cholera cases declined from 5,141 to 3,254. During the year 157,737 operations were performed, a decrease of 6,204 on the number of the previous year. The results show that 149,858 were cured and 402 died. Of the more important operations 1,420 were for cataract.

Bombay. The number of medical institutions in Bombay Presidency rose to 316, an increase of four on the number at work in 1902, but the patients treated decreased by 23,868. The in-patients numbered 50,734, and of these 33,788 were cured and 6,339 died. The most common diseases were as usual malarial fever, but during the year the admissions decreased in number as also did admissions from cholera and bowel complaints. The number of patients admitted into the hospitals and subsequently found to be cases of plague was 1,197, of whom 356 died and the remainder were transferred to plague hospitals. The surgical operations performed during the year numbered 84,558 with a mortality of 490. Of the more important operations 944 were for cataract.

Lunatic Asylums.

Bengal. At the six asylums in Bengal (viz., Bhowanipore, Dullunda, Dacca, Patna, Cuttack, and Berhampore) 1,348 lunatics, including 315 fresh admissions and re-admissions, were under treatment in 1903, being an increase of 95 on the number of the previous year. In the course of the year under notice 197 patients were discharged (130 as cured), and 106 died. Compared with the figures of 1902, the number discharged was more by 73, and the mortality more by 10. At the end of the year there were 1,045 persons still under detention, or 12 more than at the close of 1902. The general health of the lunatics was satisfactory during the year. The number of admissions to hospital rose from 604 to 613; the average daily number of sick fell from 66 to 62; and the death-rate rose from 93·5 to 100·5 per 1,000 of average strength. There were ten cases of cholera against one in 1902. The cause of insanity was traceable only in 46 per cent. of the total number of lunatics, and 183 cases were ascribed to ganja smoking.

United Provinces of Agra and Oudh. The inmates of the four lunatic asylums (Agra, Bareilly, Benares, and Lucknow) in the United Provinces of Agra and Oudh in 1903 numbered 1,417, including 281 fresh admissions during the year, against 1,391 in 1902. Before the close of the year 200 patients were discharged, of whom 150 were reported as cured, and 67 died, leaving 1,150 under treatment at the end of the year. The cause of insanity was unknown in nearly half (688) the cases under treatment. The general health of the patients was very good in all four asylums, particularly in Lucknow.

Punjab. The Lunatic Asylum at Lahore continued to do useful work. The total number of lunatics in 1903 was 664 (including 161 fresh admissions), against 627 in 1902. At the end of the year the number was reduced to 537 by the discharge of 87 patients, and 40 deaths. The health of the inmates of the asylum was on the whole satisfactory: the daily average sick fell from 45 to 41 and the death-rate from 79·4 per 1,000 of average strength to 76·4. The cause of insanity was unknown in 288 of the cases under treatment. A new Female Lunatic Asylum has been constructed to accommodate nine Europeans and 64 natives.

Burma. The Rangoon Asylum is the only one in the province of Burma, and has accommodation for 416 insanes. During 1902 there were 544 patients in the asylum, including 122 fresh admissions, and the total was reduced at the close of the year to 442 by the discharge of 65 patients for different causes and the death of 37. The health of the asylum was on the whole good during the year. No epidemics prevailed and the average daily sick fell from 33 to 23, and the death-rate from 105·7 per 1,000 of average strength to 86·7. The cause of insanity was unknown in 269 cases.

Central Provinces. In the two asylums of the Central Provinces (Nagpur and Jubbulpore) there were 361 lunatics under treatment during 1903, an increase of 4 on the number in 1902. In the course of the year 33 patients were discharged as cured or otherwise and 22 died, leaving 306 still under treatment at the end of the year. In the Nagpur Asylum the year was not a healthy one especially among the female inmates, owing to a severe outbreak of influenza at the end of March resulting in 31 attacks with 7 deaths. Of the total 22 deaths, Nagpur recorded 14, being in the ratio of 89·7 per 1,000 of average strength against 7 or 45·9 in 1902. At Jubbulpore there were 8 deaths, being in the ratio of 51·9 per 1,000, against 6 or 39·2 in 1902. The cause of insanity was unknown in 152 cases.

There is only one lunatic asylum in the province of Assam, and this is situated in Tezpur. The total number of lunatics under treatment in the asylum during 1903 was 182, or 9 more than in the previous year. Of these, 28 were fresh admissions. At the close of the year the patients in the asylum were reduced to 157, 15 of the total number having been discharged, and 10 having died. The daily average sick was 11 against 10 in the previous year, and the death-rate rose from 56·0 per 1,000 of average strength to 64·3. The increase in sickness was partly due to overcrowding, and in view of the increased numbers of patients in the asylum the construction of a new male ward has been sanctioned. The cause of insanity was unknown in 117 cases. Assam.

At the commencement of 1903 there were 574 patients under treatment in the three lunatic asylums (Madras, Vizagapatam, and Calicut) of the Madras Presidency. During the year 170 fresh cases were admitted, bringing the total population up to 744, or 8 more than the number in the preceding year. In the course of 1903 there were 116 cases of discharge, and of these 102 were cured or improved. The accommodation was ample, and there was no overcrowding in any of the asylums during the year. There was slightly less sickness among the patients than in the previous year. The daily average sick fell from 48 to 47 and the deaths from 45 or 77·6 per 1,000 of average daily strength, to 41 or 69·0. There was no epidemic in any of the three asylums. The cause of insanity was unknown in 338 of the total 744 lunatics under treatment during the year. Madras.

The total population of the seven lunatic asylums of the Bombay Presidency was 1,114, including 317 fresh admissions, against 1,295 in 1902. In the course of the year 266 patients were discharged, 93 of them as cured, and 66 died, leaving 782 under treatment at the close of the year. The health of the inmates remained good and considering the average population of the asylums there has been a marked decrease in the amount of sickness during the last three years. The daily average sick fell from 38 to 34, and the death-rate, per 1,000 of average strength, from 90·0 to 83·0. Of the total of 1,114 lunatics, the cause of insanity was unknown in 511 cases. Bombay.

Medical Schools.

The number of medical schools open in Bengal during 1903–04 was 11, the same as in the previous year. The Medical College, Calcutta, and four of the medical schools are maintained by Government, the rest are unaided. The college consists of two departments, viz., the English department and the military pupil class. The four Government medical schools train pupils as Civil Hospital Assistants, and the six unaided schools follow their own standards for private practice. Bengal.

The students of the Medical College are required to undergo three University examinations during their five years' study, viz., the Preliminary Scientific examination at the end of the second year, the first L.M.S. or the first M.B. examination at the end of the third year, and the second L.M.S. or second M.B. examination at the end of the fifth year. The total strength of the College at the end of the session 1903–04 was 519 (including 16 women), against 555 in the preceding year. As regards the examinations, 206 candidates were successful, or at the rate of 48·4 per cent., as compared with 45·3 per cent. in the previous year. Of the 206 successful candidates, 26 passed the Preliminary Scientific L.M.S. examination, 59 passed the first, and 59 the second L.M.S. examinations; 29 passed the Preliminary Scientific M.B. examination; 12 passed the first and three the second M.B. examinations. In the combined Preliminary Scientific and First L.M.S. examinations there were only seven candidates, but five passed; and 13 passed the combined Scientific and First M.B. examinations.

The average number of students attending the four Government Vernacular Medical Schools at Calcutta, Patna, Dacca and Cuttack was 741. 91 pupils passed the final examination.

The number of pupils attending the Agra Medical School in 1903–04 was 258 (including 54 women), or 14 more than in the preceding year. The results of the examinations were satisfactory, the percentage of successful candidates was 69 in the Civil Class and 56 in the Military Class. The pupils are carefully examined at the end of each year's work, and are not promoted to the next higher class unless they pass the annual examination of their class. United Provinces of Agra and Oudh.

Punjab. The average attendance at the Lahore Medical College and School was more by 13 as compared with that of 1902–03, viz., 542 against 529. Of these 234 were in the College and 308 in the Medical School. The results of the year's examinations show that for the Preliminary Scientific Examination 42 out of 73 candidates passed. In the first L.M.S. and M.B. examinations 20 candidates out of 40 passed, against 25 out of 28 in the previous year, and in the second L.M.S. and M.B. examinations 22 out of 25 passed, against 20 out of 39 ; in all 84 out of 138 or 61·0 per cent. were successful, as compared with 83 out of 122, or 68 per cent. in the previous year. In the School department 84 candidates went up for the final examination for the hospital assistant diploma and 58 passed or 69 per cent., against 60 passes out of 92 candidates in the previous year.

The North India Medical School for Christian women at Ludhiana had 42 students on the rolls at the end of 1903, or seven less than in the previous year ; of these 19 belonged to the Medical class, six to the Compounders' classes, nine to the Nurses' classes and eight to the *dais*.

Madras. The average number of students at the Madras Medical College (including the School Department) during 1903–04 was 324, of whom 32 were women students. Of the 150 students in the College for the various examinations in medicine (including 11 women) 128 candidates entered and 76 passed, against 64 out of 111 in 1902. In the school department the students numbered 174 (including 21 women) and for the final examination for the Apothecary grade 17 candidates appeared and 13 passed, and 97 of the previous year's class of sanitary inspectors appeared for the Government examination in hygiene and 56 passed.

The Hospital Assistant department of the Medical College was at the beginning of the year transferred to Royapuram and constituted into a separate school. This school and the other two medical schools at Vizagapatam and Tanjore had on their rolls 245 pupils, and of these 80 appeared at the final examination of hospital assistants and 59 passed.

Bombay. The attendance at the Grant Medical College, Bombay, rose from 657 in 1902–03 to 677 (including 45 women) in 1903–04. For the first University examination in medicine 178 candidates presented themselves, of whom 121 passed ; and for the second examination in medicine 95 passed out of 197 candidates. For the final examination for the degree of L.M.S there were 122 candidates, and of these 65 passed, two of whom were women.

The Government Medical Schools at Poona, Ahmedabad, and Hyderabad continued to work satisfactorily. The average daily attendance was 237.

VII.—SANITATION.

In Calcutta substantial progress was made during the year in ridding the city of many objectionable and insanitary bustees or collections of native huts, resulting in the opening up of many unhealthy areas by the construction of public squares and the making of new roads or widening old ones. The scheme for the drainage of the suburbs was well in hand, and large portions had been completed; but they could not be utilised until other portions had been carried out. The scheme for the surface drainage of the suburbs was under preparation. Satisfactory progress was made with the conversion of the intermittent to a continuous filtered water-supply, the population supplied under the scheme having nearly doubled during the year; in the area under constant supply the average daily consumption during the year was 21·5 gallons a head. The corporation have sanctioned a scheme to increase the daily supply by six million gallons by the erection of new pumps at Pulta. A scheme was also under consideration for improving the unfiltered water-supply by the substitution of larger mains, &c. Bengal.

In many of the other towns of Bengal much good work was done in improving sanitation and water-supply. In the south suburbs of Calcutta the filtered water-supply scheme was completed, and the new scheme for improving the water-supply of Darjeeling was brought into operation. In the towns of Burdwan, Asansol, Manicktolla, Barisal, Gaya and several others, schemes for extending or improving the water-supply were also in progress. Schemes for the improvement of drainage were in course of preparation for several towns.

The Sanitary Board held four meetings during the year, and continued to advise the Government and local bodies on the important sanitary projects. The Board also continued the inquiry into the septic tank system of sewage disposal, and prepared estimates for the construction of septic tank latrines in several municipalities.

In the United Provinces of Agra and Oudh many sanitary improvements in various directions were effected during the year 1903. Large drainage works were in progress at Benares, Cawnpore, Agra, Lucknow, and other towns, and expensive schemes for Fyzabad and Mirzapur were sanctioned. As part of the programme of plague prevention a grant of over £13,000 was made by the Local Government in the spring of the year for the general cleaning up and sanitary improvement of smaller municipalities and towns. A further grant of £4,000 was also made for the improvement of wells in the smaller centres of population. In addition the Government propose to relieve the municipalities from the year 1904 of police charges to the extent of about £23,000 and to make a special grant of about £6,700 for cleaning up certain towns and large villages. On the whole, activity in sanitary matters was the most prominent feature of the municipal administration of the year, and the liberal subsidies given by the Government to the poorer towns enabled them to carry out much useful work. United Provinces of Agra and Oudh.

The Sanitary Board held seven meetings during the year at which they considered and approved projects, amounting to over £84,000, for improving the sanitary condition of municipalities. The estimates show an increase of 16 per cent. on those of the previous year.

In the Punjab good progress was made during the year in the important works which have been undertaken for the improvement of the sanitation of Simla, and in the water-works of Amritsar city. The Lyallpur drainage and water-works were completed, some progress was made with the intra-mural drainage scheme of Delhi city, and improvements to the water-supply were in hand in Lahore, Umballa and Dharmsala. Interesting experiments have been made with septic tanks in Simla, and as the results on the whole have been satisfactory it has been decided to install tanks at once at all the outfalls and to continue experiments with the filters. Special attention was being given to village sanitation, and good progress was made in the matter of protection and clearance of wells. The system of village sanitary notebooks is in force in every district, and is found to be of considerable value. Punjab.

Six meetings of the Sanitary Board were held during the year, when several drainage and water-supply schemes were considered and approved and forwarded to the Local Government for disposal.

North-West Frontier Province.

No large sanitary works were completed in the North-West Frontier Province in 1903, but considerable sums were expended on minor works in the municipal towns, and "these works," it is stated, "may be expected to improve the already excellent sanitary conditions of these towns, which is shown by the freedom from epidemic disease which they enjoy." The expenditure on sanitary works was equal to 20 per cent. on the aggregate income of the municipalities. At the close of the year an extensive drainage scheme was begun for the city of Dera Ismail Khan. In Peshawar city a sum of nearly £1,900 was spent on the water-supply improvements, and on the extension and up-keep of its drainage system ; and in several other places attention was paid to water-supply by the construction of new wells and the cleaning out of old wells and tanks.

Burma.

The municipalities of Burma spent 54 per cent. of their income on sanitary works, and more than half (32 per cent.) of this was expended on works connected with water supply. The Hlawga water-supply scheme at Rangoon which is being carried out to augment the present supply from Victoria Lake, was approaching completion, and the new supply is expected to do much to improve the health of the town. The Mandalay water project has been completed, and the waterworks for Moulmein and Prome were in course of completion. Some progress was also made with the Prome drainage project. A successful experiment in the disposal of refuse was made by the construction of a septic tank at Maymyo, and the engineer's interesting report on the working of the installation has been commended to the attention of all municipal bodies in Burma. On rural sanitation a sum of nearly £11,000 was expended during the year by District Funds.

The Sanitary Board met on two occasions in the course of the year, when sanitary projects referred by Civil Officers and municipalities were considered, among them being proposals for a surface drainage scheme and for an underground sewage system for Moulmein town.

Central Provinces and Berar.

No new sanitary work of any great importance was undertaken in the Central Provinces and Berar during 1903. In connection with the Nagpur waterworks a sum of £3,800 was expended in laying a duplicate rising main, and in providing a new pump. In Bhandara and Burhanpur the water-systems were extended, and that at Harda improved, and in Khandwa and Burhanpur drainage surveys were completed. In the municipalities a number of minor sanitary works were carried out during the year chiefly in connection with improvement of the water supply and the construction and repair of drains. As regards rural sanitation, good work was done under conservancy and clearing of village sites. No new villages were brought under the provisions of the Village Sanitation Act during the year. A special grant of £1,670 was made by the Local Government for the improvement of the water supply in the villages and a scheme for its expenditure was approved. The Village Sanitation Act is not in force in any Berar villages.

Meetings of the Sanitary Board were held during the year at the head-quarters of all districts in the Central Provinces with the exception of Seoni and Nagpur. Steps have been taken to maintain in each district council's office a record of desirable works of village sanitary improvement, as well as a register of all wells constructed in connection with the sanitary scheme, with a view to their being periodically inspected and kept in good repair. In Berar the meetings of the Sanitary Board have hitherto been held at district head-quarters during the rains. There is nothing in the nature of a district sanitary scheme. Proposals for sanitary improvements have usually been made by the Sanitary Commissioner, and the cost debited to district funds. Apparently no local aid has ever been sought. It is stated that it will probably be found desirable to alter the constitution of the Board and its procedure.

Assam.

No important sanitary work was undertaken in Assam during the year, and there was no provincial scheme of any importance under consideration. Excluding four small towns which have no separate income of their own, the municipalities spent over 73 per cent. of their total income on sanitary works. In rural areas the sanitary improvements effected were chiefly in the direction of providing a purer water supply by the construction and repair of wells and tanks, and in improving village sites. The system of village sanitary inspection books was kept up in certain villages, but in several cases continued neglect was shown with regard to the submission of the books, and in others they were reported as of no practical value.

No meetings of the Sanitary Board were held during the year. The Sanitary Commissioner was consulted unofficially on all matters relating to sanitation, and during

the touring season he inspected the sanitary condition of all the headquarter stations and of nearly all the sub-divisional towns, and in some placed on record criticisms for information and guidance.

In Madras City progress was made with the new drainage scheme and a number of minor sanitary improvements were carried out, consisting chiefly in the closing of unused wells, &c. The quantity of water supplied to the city from the Red Hill Lake was nearly 2½ per cent. greater than in the previous year, and the level of the lake was about half an inch higher at the close of the year than at the beginning. Madras.

As regards sanitation in the other municipalities of Madras Presidency, the Vizagapatam and Cocanada water-works were completed and open for use, and those at Coonoor, Guntur and Dindigul were in course of construction. No drainage schemes of importance were executed during the year, but the scheme for the drainage of a portion of Madura town was completed and submitted for the approval of Government. Experimental filters were constructed for the disposal of the sewage from the King Institute of Preventive Medicine at Guindy. Schemes for improving the water supply of several towns were under consideration, as well as schemes of drainage for others. In addition plans and estimates relating to 101 minor sanitary works were checked and scrutinized by the Sanitary Engineer, who also prepared a type design for wooden staging for drawing water from tanks.

The Sanitary Board did good work during the year. They scrutinized the plans and estimates relating to 149 sanitary works of the total estimated cost of £118,000, amongst the more important being the drainage of Madura and Ootacamund, the water supplies of Vellore, Yercaud and Kodaikanal, improvement of the sanitation of Ootacamund, improvements to the market at Coonoor and a general market at Calicut.

In Bombay City progress was made with the special drainage scheme. The Fergusson Road and Chinchpokli sectional sewerage works and the Parel sectional sewerage works were completed during the year. The drainage works in connexion with the scheme for subsoil and surface drainage were commenced; and other works of a minor character were in progress. Drainage connections were carried out for 711 houses, and the work of constructing public latrines and urinals in various parts of the towns was pushed on. The lakes and reservoirs which supply the city with water were maintained in good condition. The rainfall was plentiful, and the Tansa and Tulsi lakes were fully replenished. In the course of the year 329 new water connections were made and 179 were cut off, leaving a total at the end of the year of 20,833. Bombay.

With the exception of Ahmedabad and Karachi none of the other municipalities of the Presidency were in a condition to undertake costly works, their available funds being required for minor works which had been postponed owing to the expenditure and loss of revenue due to plague and famine. At Ahmedabad the extension of the drainage made good progress, and the municipality raised a further loan of £20,000, for continuing the work. For the extension of the Karachi drainage, estimated to cost £78,000, the municipality applied for a loan, and the Sanitary Commissioner visited the town and reported on the scheme. The Village Sanitation Act was in force in 265 villages against 294 in the previous year, the decrease being due to the abolition of 37 non-working committees in the Poona District. The Act provides for the establishment of a sanitary committee or a sanitary board, consisting of members chosen by the collector of the district or by the local Government to supervise sanitary matters. Sanitary inspection books have been introduced into 3,598 villages, and in 51 per cent. of these the books have been written up by officers of the Sanitary Department. In Broach the books have been introduced throughout the district.

The Sanitary Board met only once during the year when a number of minor questions were discussed, and a recommendation was made that two surveyors should be appointed to work under the Sanitary Engineer for the purpose of preparing small projects for municipalities.

INDIA OFFICE,
October, 1905.

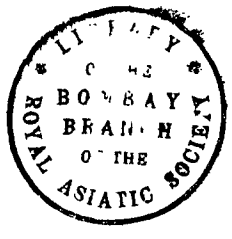
ABSTRACTS

OF

SANITARY AND OTHER REPORTS

FOR

1903.



21397

ABSTRACT OF THE REPORT OF THE SANITARY COMMISSIONER WITH THE GOVERNMENT OF INDIA, FOR 1903.

(*Lieutenant-Colonel J. T. W. Leslie, I.M.S.*)

LIBRARY OF THE BOMBAY BRANCH OF THE ROYAL ASIATIC SOCIETY

Meteorology of the Year.

Summary of the meteorological phenomena of the year.—The following report on the meteorology of India has been kindly furnished by the Meteorological Department of the Government of India.

During the first half of January the weather over India was generally quiet and fine, though some rain occurred over the south, centre, and north-west, between the 5th and the 10th. About the 20th the weather changed and a series of storms passed through Persia and Baluchistan into Northern India, occasioning rain on the plains, snow on the hills and very unsteady temperatures. These conditions were not, however, maintained and the weather was even finer and quieter in February than in January and the month was marked by a considerable, persistent and general excess of pressure, great dryness of the air, absence of cloud and deficiency of rainfall. In January the weather was cooler than usual over north-west and north-east India and hotter than the average elsewhere, while in February the mean temperature was lower than the normal except in the extreme north-west and extreme north-east. The rainfall of January was deficient except over south India, the west coast and north-east India, and that of February was deficient except along the west coast, over Bengal and on the Burma coast. In March the weather was more disturbed than usual in the north-west of India and adjacent regions, and the total rainfall of the month was from twice to six times the normal amount over Baluchistan, the North-West Frontier Province, the Punjab, Kashmir, Western Rajputana and the hill districts of the United Provinces. In Burma, Bengal and Assam the month's rainfall was normal or in slight excess, while elsewhere the dry weather which had characterised the two preceding months still held. The air was drier and the cloud amount less than usual except in parts of north-west India, but the mean temperature, owing probably to the unsettled weather in the north-west was lower than the average in all divisions, but particularly so in the Indus valley and north-west Rajputana.

During the two hot weather months of April and May the rainfall was much lighter and the disturbances fewer than usual over Burma and north-east India, but in the Gangetic Plain and Chota Nagpur in April and in north-west India and the Peninsula in May the rainfall exceeded the normal. In consequence, while the mean temperature was in marked excess over north-east India and Burma, it was generally below the normal elsewhere. The highest temperatures recorded during May were 120° at Jacobabad on the 31st and 114·8° at Ahmedabad on the 21st.

The monsoon rains set in along the west coast between the 11th and the 16th of June, and over Bengal on the 16th, but the monsoon was light on both sides of India throughout that month. Monsoon rainfall did not extend properly inland and the whole of the area served by the Arabian Sea branch of the monsoon current reported more or less deficient rain. In north-east India the rainfall was generally excessive, but this result was largely due to the very showery weather which prevailed there during the first half of the month. Both the cloud amount and the humidity were generally low. As a result of these conditions the temperature on the mean of the month was normal or in slight defect over inland Burma, Assam and Bengal and Orissa, but was in considerable excess elsewhere, most so over the central parts of the country, where the heat was very excessive from the 8th to the

25th. The temperature rose to 123·5° at Jacobabad on the 11th, to 119° at Montgomery on the 13th, to 118·2° at Dera Ismail Khan on the 13th and 14th, to 117·8° at Bikaner on the 15th, and to 116·4° at Jhansi on the 10th. During the first eleven days of July scattered, though in places heavy, rain fell over the south of the Peninsula, the Burma Coast and north-east India, but none was received over northern India or the north of the Central Provinces. In consequence, very excessive temperatures prevailed over West Bengal, the Gangetic Plain, and the adjacent districts of the Central Provinces, Central India, Rajputana and the Punjab, where on some days the maximum temperature was between 15° and 18° higher, and the mean temperature between 14° and 18° higher, than usual. The highest maxima reported were 117·6° at Jacobabad on the 9th and 10th, 117·7° at Dera Ismail Khan on the 10th and 117·5° at Peshawar and Sialkot, also on the 10th. On the 12th July a change occurred, and rain extended, accompanied with a fall of temperature, but the rainfall was not steady, and a partial break in the rains prevailed over northern India from the 24th to the end of the month. The temperature on the mean of the month was excessive over northern India and Burma —more particularly over the Gangetic Plain—while it was normal or in slight defect over the Peninsula, the North-West Frontier Province and the North-West Himalayas. The cloud amount and the relative humidity were both below the normal except over the Peninsula, where both were in excess. The rainfall of the month was about normal on the Burma Coast, short of the normal over inland Burma and northern India, except the extreme north-west, and in excess over the Peninsula.

During August the Arabian Sea monsoon was on the whole weak and the rainfall normal or slightly below the normal over the west and centre of the Peninsula and north-west India. On the other hand the Bay monsoon was strong and a succession of storms passed from the Bay inland and the month's rainfall was heavier than usual over the east of the Peninsula and Central and north-east India. The mean temperature of the month was nearly normal except in Sind where the heat was somewhat excessive. The highest maximum temperature recorded was 113·8° at Montgomery on the 23rd. Both humidity and cloud were, on the whole, less than the average.

Conditions were unchanged during September. The monsoon was, on the whole, weaker than usual over the Arabian Sea, but the rains continued in Upper India till between the 12th and the 19th. The Bay monsoon was, on the contrary, active, and a series of small storms was formed and occasioned rain over north-east India. The general rainfall of the whole country was in excess of the normal. The departures of the mean temperature from the normal were generally small and unimportant. The air on the mean of the month was damper than usual and the mean cloud amount in excess of the average.

During October and November the weather was generally quiet and fine over the extreme north-west of India, but was disturbed elsewhere. Excessive rain fell in the former month over the greater part of northern and central India, while over the Peninsula the usual rains from the north-east monsoon partially failed. In November the area of fine weather extended and covered all parts of the country except Assam, inland Burma and south India, where the rainfall was excessive. The mean temperature varied irregularly from the normal in these two months.

The first three weeks of December were fine over northern India, but disturbed and showery over the south of the Peninsula and the Burma Coast. About the 24th the weather changed in the north-west and between the 25th and the 28th general rain fell over the plains of north-west India and heavy snow on the hills. The temperature on the mean of the month was lower than usual in most places, but especially so over the Western Desert, the west of the United Provinces, part of Central India, Orissa and inland Burma. Both cloud and humidity were below the normal over nearly the whole country.

The temperature conditions were fairly normal on the mean of the year. Mean temperature was in slight excess over the Burma Coast and the Bay Islands and in slight defect over the Indus Valley and north-west Rajputana.

Pressure on the mean of the year slightly exceeded the normal over the Indian area except along the west coast and over south India, where it was in very slight defect. For the whole Indian area the departure from the normal was + ·005 inch, and, as in the previous year, the departures from the normal were very large both in February and in October.

The relative humidity, on the mean of the year, was below the normal over the whole of India, with the exception of south India, where it was in slight excess. The air was damper than usual in September and October and drier generally in the remaining months.

The cloud amount was generally above the normal in January, May, September and October, but varied irregularly from the average in the other months of the year. On the mean of the year it was in slight excess over Bengal and Orissa, the Gangetic Plain and Chota Nagpur, the Deccan and south India and below the normal elsewhere.

The rainfall of the whole year was in slight to moderate defect over inland Burma, Bengal and Orissa, the Gangetic Plain and Chota Nagpur and the Upper Sub-Himalayas, but was normal or in excess in all the remaining divisions. On the mean of the whole area for the year there was an excess of 0·30 inch. The rainfall was generally in excess in August, September and October, and was irregularly distributed in the remaining months of the year.

European Troops.

Sickness and mortality in 1903.—The average strength of the European troops, excluding officers, which was 60,540 in 1902, rose to 70,445 during 1903; the number of new arrivals in the country was 24,840 and 15,126 in the corresponding trooping seasons. The statement below will show at a glance the general position as regards the sickness and mortality in 1903 as compared with the previous year and the antecedent quinquennium, and this will be seen to be, in all respects, favourable. The ratio of admissions to hospital is the lowest on record, and one must go back to 1877 to find a lower constantly-sick-rate; the death-rate has been lower on seven occasions, but it is so far satisfactory in the light of the facts that 51 per cent. of the strength was under 25 years of age, and that 28 per cent. had less than one year's service in India.

Years.	Average Strength.	Ratio per 1,000 of Strength.				
		Admissions into Hospital.	Constantly Sick.	Deaths.	Invaliding.	Total Loss.
1897–1901... ...	65,044	1,285	81	16·69	35	52
1902	60,540	1,078	66	14·68	37	52
1903	70,445	1,033	63	13·05	29	42

The chief causes of sickness were venereal diseases and ague, which accounted for 23·9 and 23·5 per cent., respectively, of the total number of admissions from all causes. The decrease in sickness is to be attributed chiefly to lower admission-rates from malarial fevers, venereal diseases, respiratory diseases excluding tubercle, dysentery and hepatic affections, while the most notable increase was observed in those from simple continued and enteric fevers, influenza, cholera and heatstroke.

The chief causes of mortality were, as usual, enteric fever and abscess of the liver, the former yielding 32 per cent. and the latter 9·9 per cent. of the total number of deaths, but there was a slight fall in the rates from both these diseases as compared with 1902. And this is the case with nearly all the other death causes, the only notable exceptions being small-pox and cholera.

The chief causes of invaliding were, in order, ague, debility, secondary syphilis and *Bilharzia hæmatobia*, which together accounted for more than one-third of the

total, but there was a remarkable decrease in the numbers sent home on account of secondary syphilis and debility; 134 of the 158 cases of invaliding for *Bilharzia* are definitely noted as having been contracted in South Africa, and probably all owe the same origin. If this new and exceptional source of loss be deducted from the total number invalided, the rate per 1,000 falls to 27·4, the lowest figure since 1895.

Among the troops composing the Delhi manœuvres and Durbar force the chief causes of sickness were venereal diseases and ague, and of mortality, enteric fever and pneumonia, which together accounted for 66 per cent. of the total of 15 deaths which occurred up to the end of February when demobilization took place. From the Aden Column Field Force, with an average strength of 832, there were reported altogether 719 admissions and 23 deaths, giving ratios of 864 and 27·64 per 1,000 respectively; ague and dysentery were accountable for 47 per cent. and 8 per cent. of the sickness, and dysentery and enteric fever together for just over half the mortality.

Commands and Stations.—Comparing the year with its predecessor, and taking all factors of sickness and mortality into account, all the four commands as hitherto considered, exhibit a better standard of health, save Madras (including Burma) which shows no change. Henceforth the statistics of Burma will be discussed separately, and in this, the first year of the new arrangement, it shows, with Madras, the highest sick-rates, the lowest being returned from Bengal and the Punjab. On the other hand, Bengal (15·46) and Burma (13) have the highest death-rates, and Madras (9·24) the lowest, all being somewhat above the respective rates for 1902, and the decrease in the combined death-rate for India is due to the falls in the Punjab and Bombay ratios of 1·5 per 1,000 and 7·26 per 1,000 respectively; the latter and more remarkable result is due to a decrease under nearly every chief cause of death. Among stations with a strength of over 100, the highest death-rates were recorded at Naini Tal (42·25), Delhi (40·27), Dinapore (39·08), Murree (39·06), Mian Mir (36·77), and Nasirabad (35·66), the chief causes of excessive mortality being enteric fever, abscess of the liver, cholera and dysentery, one or more predominating in the different places. Turning to the largest stations, those with a strength of over 1,000, of which in 1903 there were 20 with an aggregate strength of 34,278, it is found that the combined admission-rate (all causes) was 998 and the death-rate 12·28 per 1,000, both below the means for India. Among these cantonments the highest death-rates were reported from Peshawar (22·15), Meerut (19·65), Ranikhet (19·06), Umballa (18·95), and Sialkot (18·41), enteric fever and cholera being the chief causes of the excess. In nine of these stations the death-rates were under 10 per 1,000.

Geographical Groups.—The geographical groups which, on a consideration of the sickness and mortality rates in combination, may be said to have been most unhealthy in 1903, were Burma Coast (I), Central India (VIII), and Bengal-Orissa (IV), while at the other end of the scale stand the Hill Stations (XII *a*), Western Coast (X), and Deccan (IX). The death-rates in the former were 15·38, 20·01, and 15·17 respectively, in the latter, 8·87, 8·37, and 8·97, or if the actuals of the two sets be combined, the rates stand at 18·48, and 8·88 per 1,000 respectively, *i.e.*, as just over 2 to 1; the respective combined admission-rates are as about $1\frac{1}{2}$ to 1. The clearest view of the causes of this contrast may be obtained by a glance at the table on page 40, but it may be noted here, briefly, that malarial fevers, bowel complaints, venereal diseases and hepatic affections were more prevalent in the former groups, and that the greater mortality therein was chiefly due to enteric fever, respiratory diseases, dysentery and hepatic abscess. Some idea of the occasional fluctuation of the mortality rates in the same group from year to year is obtained when it is noted that in Bengal-Orissa (IV.) the death-rate fell from 24·32 in 1902 to 15·17 in 1903, mostly due to the decrease in deaths from hepatic abscess; again, in the Western Coast (X), the fall was from 21·34 to 8·37 in the year under review, owing chiefly to diminished loss from enteric fever, respiratory diseases and hepatic abscess.

To sum up the main results for 1903: if the sickness, mortality and invaliding rates had been the same as those of the previous year, there would have been 3,162 more men admitted to hospital, 220 more constantly sick, 115 more deaths, and 561 more men invalided. These considerations should enhance the significance of

Ratios of Commands.

	Ratios per 1,000 of the Average Strength.					
	Bengal Command.	Punjab Command.	Madras Command.	Burma District.	Bombay Command.	India.*
I.—Strength	21,860	17,997	9,375	3,616	15,990	70,445
II.—Constantly-Sick-Rate of the Year	63·4	56·5	73·3	73·0	64·7	62·9
III.—Admission-Rate of the Year—						
Influenza	5·5	·4	3·6	2·5	1·4	3·1
Cholera...	1·7	2·2	—	·3	·2	1·1
Small-pox	1·9	·8	—	—	·4	1·0
Enteric fever	22·6	19·8	11·3	7·7	23·1	19·6
Intermittent fever	188·6	312·1	135·1	210·7	307·8	242·6
Remittent fever	3·6	4·8	3·9	12·4	2·1	4·0
Simple continued fever	23·7	21·1	12·8	15·5	14·1	18·5
Tubercle of the lungs	2·2	3·0	3·5	3·6	5·5	3·4
Pneumonia	4·4	4·8	3·0	1·7	4·9	4·6
Other respiratory diseases	20·3	18·0	20·5	32·6	21·0	20·5
Dysentery	20·2	10·6	18·3	24·6	14·3	16·9
Diarrhœa	14·1	15·8	9·0	16·0	12·4	13·5
Hepatic abscess	3·3	1·7	1·1	2·5	2·9	2·4
„ congestion and inflammation	12·8	10·1	11·9	8·0	13·3	11·8
Venereal diseases	251·1	176·1	334·7	346·2	259·6	247·0
All Causes	977·4	1,007·2	1,070·8	1,172·0	1,115·2	1,033·4
IV.—Death-Rate of the Year—						
Cholera...	1·10	1·72	—	·28	·06	·81
Small-pox	·23	·11	—	—	·06	·11
Enteric fever	4·39	4·39	2·77	3·04	4·63	4·19
Intermittent fever	·09	·33	·21	1·38	·31	·34
Remittent fever	·05	·11	·11	1·38	·06	·14
Simple continued fever	—	—	—	—	·06	·01
Heatstroke	·87	·67	·21	—	1·25	·77
Circulatory diseases	·59	·89	·64	·28	1·06	·77
Tubercle of the lungs	·27	·11	—	·28	·50	·24
Pneumonia	·73	·33	·11	·83	·50	·57
Other respiratory diseases	·41	·06	—	·28	·19	·21
Dysentery	·73	·44	·53	2·21	·25	·70
Diarrhœa	—	—	—	—	—	—
Hepatic abscess	2·20	·83	·96	1·38	·88	1·29
All Causes	15·46	12·56	7·79	13·00	12·32	13·05

* Including Delhi manœuvres and Durbar Force and Aden Column Field Force.

the comparatively small variations in the rates, when they refer to a large body of men, and they indicate the great importance in regard to efficiency of every measure that promotes the health of the army.

Ratios of Geographical Groups.

	Ratios per 1,000 of the average strength.												
	I. Burma, Coast and Bay Islands.	II. Burma Inland.	IV. Bengal and Orissa.	V. Gangetic Plain and Chutia Nagpur.	VI. Upper Sub-Himalaya.	VII. North-Western Frontier, Indus Valley, and North-Western Rajputana.	VIII. South-Eastern Rajputana, Central India and Gujarat.	IX. Deccan.	X. Western Coast.	XI. Southern India.	XII. *a.* Hill Stations.	XII. *b.* Hill Convalescent Depôts and Sanitoria.	India.
I.—Strength	975	2,408	1,912	6,831	13,261	4,742	6,097	10,262	1,672	3,573	9,921	3,673	70,445
II.—Constantly-Sick-Rate of the Year	103·4	64·6	76·0	66·8	62·7	56·9	73·2	66·1	60·7	73·9	49·1	69·3	62·9
III.—Admission-Rate of the Year:—													
Influenza	3·1	1·7	23·0	1·8	1·0	—	·2	3·0	·6	8·7	4·9	·8	3·1
Cholera	—	·4	4·2	·6	2·6	1·1	—	—	—	—	2·6	·8	1·1
Small-pox	—	—	·5	4·4	·5	1·7	·8	·2	1·8	—	·2	—	1·0
Enteric fever	9·2	7·5	4·2	25·9	27·5	14·6	41·3	17·5	2·4	16·0	13·5	12·3	19·6
Intermittent fever	261·5	171·9	208·2	147·6	319·8	403·4	441·0	217·3	126·8	95·4	109·7	185·7	242·6
Remittent fever	31·8	2·5	6·8	2·2	3·1	11·2	4·8	4·2	1·2	·3	1·8	4·9	4·0
Simple continued fever ..	13·3	17·9	16·2	46·1	16·2	40·3	13·8	12·8	3·6	17·6	14·8	7·9	18·5
Rheumatic fever	—	·4	—	·3	·4	1·3	·2	·8	—	·8	·5	·8	·5
Tubercle of the lungs ..	4·1	3·7	1·6	1·8	3·5	1·1	1·8	3·0	5·4	2·5	2·2	6·5	3·4
Pneumonia	1·0	1·7	5·2	2·8	6·1	4·0	5·4	3·0	5·4	3·9	4·3	3·3	4·6
Other respiratory diseases	53·3	26·6	30·9	20·6	17·1	16·2	16·7	19·0	16·1	17·9	23·1	25·3	20·5
Dysentery	65·6	9·1	32·9	18·0	14·7	8·0	21·5	13·4	9·6	15·1	11·0	19·3	16·9
Diarrhœa	35·9	9·1	12·6	8·5	17·4	7·6	15·4	9·4	6·6	8·1	19·2	21·5	13·5
Hepatic { abscess	5·1	1·7	5·2	3·7	1·8	·8	5·1	1·0	·6	1·4	2·1	2·7	2·4
Hepatic { congestion and inflammation.	7·2	8·3	13·1	10·8	11·5	8·4	9·8	11·5	13·8	9·8	14·7	18·5	11·8
Venereal diseases	517·9	290·3	404·3	236·7	198·2	172·9	252·6	344·4	325·4	340·3	169·0	253·5	247·0
All Causes	1,667·7	1,004·6	1,225·9	946·9	1,044·4	1,098·1	1,314·9	1,090·4	899·5	1,092·9	744·4	1,027·2	1,033·8
IV.—Death-Rate of the Year—													
Cholera	—	·42	2·62	·29	1·89	1·05	—	—	—	—	1·71	·54	·81
Small-pox	—	—	—	·73	—	·42	—	—	—	—	—	—	·11
Enteric fever	2·05	3·74	·52	4·83	6·11	4·13	8·53	3·90	1·20	4·48	1·71	2·72	4·19
Intermittent fever	—	1·25	—	·29	·38	—	·33	·10	—	·28	·20	·27	·34
Remittent fever	—	1·66	·52	—	·15	—	·16	·10	—	—	·10	—	·14
Simple continued fever ..	—	—	—	—	—	·21	—	—	—	—	—	—	·01
Heatstroke	—	—	—	1·46	·98	1·69	2·13	·19	·60	·28	·10	—	·77
Circulatory diseases ..	—	·42	·52	·44	·91	·21	1·31	·68	1·79	·56	1·01	·54	·77
Tubercle of the lungs ..	—	·42	—	·29	·23	—	·16	·39	·60	—	·10	·27	·24
Pneumonia	—	·83	1·57	·59	·60	—	·82	·10	·60	—	·60	·54	·57
Other respiratory diseases	1·03	—	—	·59	—	—	·66	·10	—	—	—	·54	·21
Dysentery	8·21	—	1·05	·59	·60	·21	1·48	·19	—	·56	·20	·82	·70
Diarrhœa	—	—	—	—	—	—	—	—	—	—	—	—	—
Hepatic abscess	3·08	·83	3·60	3·07	1·06	·21	1·64	·68	—	1·12	1·01	2·18	1·29
All Causes	15·38	11·63	15·17	16·98	15·47	11·60	20·01	8·97	8·37	9·80	8·87	10·89	13·05

Influenza.—Influenza was widely prevalent, cases occurring in all the commands and in all but one of the geographical groups (VII). The admission-rate for India, which was 8·9 per 1,000 in 1901, and 1·8 in 1902, rose again to 3·1, the incidence being greatest on the Bengal (5·5) and Madras (3·3) commands, while the Bengal-Orissa group (IV) was affected to the extent of 23 per 1,000 of its strength. Southern India (XI) and the Hill Stations (XII *a*) were the only other groups

with rates above the mean. There were altogether 215 admissions, with no fatality, reported from 29 stations, Fort William, Barrackpore, Chaubattia, and Ranikhet, with from 20 to 22 cases each, reporting 40 per cent. of the total. It is said that an epidemic wave swept over Calcutta and the district in August and September, and this accounts for the cases at the two first-named cantonments; as regards the two Hill Stations, the source of infection was not traced, but is attributed in Chaubattia to importation, the disease, however, appearing exclusively in April and May.

Cholera.—Cholera was more generally prevalent among the civil native population in 1903 than in the previous year, and this is reflected in the army returns. There were only three cases among the European troops in 1902, but the number rose to 81 with 57 deaths in the year under review; these were reported from 16 stations in which all the commands shared, but the only considerable outbreaks were in Ranikhet (24 cases with 16 deaths), Meean Meer (13 and 11), Sialkot (10 and 6), Umballa (8 and 6), and Fort William (8 and 5); seven other stations reported only one case each. In nearly all accounts it is noted that the sources of infection were abundant in that the disease was prevalent at the time among natives in the cantonments, bazaars, neighbouring towns, or villages. In the case of Ranikhet, it was concluded that a spring which had been taken into use to supplement the deficient water-supply, but which was not thoroughly protected from surface pollution, had become contaminated, probably by natives. The outbreak began three days after heavy rain, and did not cease until this source of supply was closed, although the water was boiled before issue; bacteriological examination failed to detect the *vibrio*. At Sialkot the incidence of the disease and the general course of events appeared to implicate the regimental dairy milk, though no direct source of infection of this was traced. The Fort William cases are definitely attributed to the drinking of impure water by men on the march just outside Calcutta; and at Umballa, as all connexion between the cases appeared to be excluded and no general source of infection could be traced, it was considered that each case arose independently by fortuitous contact with natives.

Small-pox.—Both the admission and death-rates on account of small-pox rose in 1903 as compared with 1902; there were 68 cases and 8 deaths recorded against 23 and 4 respectively in the previous year. Eighteen stations contributed to this result, the largest numbers being recorded in Lucknow (22 cases with 4 deaths), Peshawar (7 and 2), Agra and Bareilly 4 cases each without a fatality, and the Delhi Durbar force in camp, 5 non-fatal cases; on the other hand, eight stations furnished only one case each. It will be seen that the Punjab and Bengal Commands were chiefly affected; it was in these areas that the disease was most prevalent among the native population, and medical officers record the fact that sources of infection prevailed in and around cantonments. Of the Peshawar cases all had been vaccinated in infancy or subsequently, and 16 of the 22 had been re-vaccinated, mostly within the last five years. The disease was of the modified type in 14, and confluent in 8 cases; one man had had a previous attack in 1896 and recovered again. The cases occurring in Agra and Bareilly had all, it is said, been vaccinated and re-vaccinated.

Ague, remittent fever, simple continued fever, Malta fever.—Intermittent fever was the cause of just over 23 per cent. of the total admissions, which is about the same proportion as in 1902; it was more prevalent in all the commands, save Bengal and Madras, but the aggregate admission and death-rates fell from 247 and 0·5 per 1,000, respectively, to 243 and 0·34 per 1,000 in 1903. The separation of the Burma district from Madras Command brings out the contrast between these areas in regard to the prevalence of malarial fevers; but the high rates in Burma have been returned on a comparatively small strength, about one-fourth of which has been concentrated at one unhealthy station, Mandalay, where more than half the admissions for intermittent fever have occurred in recent years.

Excluding Burma, the Punjab Command usually takes the first and worst place, while Madras is at the other end of the list, and these positions are maintained once again in 1903, with rates of 312 and 135 per 1,000 respectively. As regards geographical groups the greatest prevalence was, in order, in Central India (VIII),

Indus Valley and Frontier (VII.), and Upper Sub-Himalaya (VI.), and the lowest in Southern India (XI.) and the Hill Stations (XII. *a*), the admission-rates ranging from 441 in Group VIII. to 95·4 in XI. Excluding the Hill Stations and comparing 1903 with the previous year, there was a decrease in the amount of the disease in 40 cantonments, an increase in 32, the Punjab Command stations alone showing an exception to the general rule of decrease, and it is among these and some in the Bombay Command that the highest rates are recorded, *e.g.*, Fort Lahore, Amritsar, Mian Mir, Aden, Nasirabad, Peshawar, and Ferozepore, all above 500 per 1,000. A reference to pages 35 and 36 will show that there was, generally speaking, a defect and an irregularity of the monsoon rains in June and July, some excess in August and September with a later persistence into October than is usual, and medical officers refer to one or other of these conditions as promoting the prevalence of fevers. The high rate at Aden is due to the men infected when on service with the Field Force operating in the Hinterland. It is quite probable, further, that just as a storm in the English Channel will often involve recourse to treatment in the London hospitals of malarial patients returning from the tropics, so the high range of temperature with cold nights in the autumn of Upper India may be expected to cause relapses in old cases of infection, or lower the resistance to fresh attacks.

Prophylactic measures.—The subject of the prophylaxis of malarial fevers is discussed as a whole in General Remarks, page 122, and it is unnecessary to give here a detailed summary of the medical transactions in this respect. There can be no doubt that the efforts put forth during the past year have been far more general, more complete, more consistently and energetically maintained and better organised than heretofore. At the same time signs are not wanting that in many respects the work has yet to be developed in its range and in completeness, before we can hope for measurable results. To this end other factors should contribute, and chief among them is a more scientific nosology based upon the recognition of the specific exciting *causæ* of the different forms of malarial fevers, and this will, of course, entail the systematic use of the microscope in diagnosis; and, further, the success of practical preventive measures will largely depend on the interest taken in, and the encouragement given to, them by non-medical officers of corps. A few of the medical officers refer to the fact that lectures on and demonstrations of the simple facts on which preventive measures are based were given to the men with encouraging results, and this is a procedure that might be more generally adopted. In some cantonments "mosquito-brigades" were organized, and from a considerable minority of stations it is reported that the *anopheles* or its larval form was discovered at one or more periods of the year, but the variety is rarely stated and there is little information as to the relative seasonal prevalence of the *anopheles* found and the forms of fever in evidence. In at least 13 stations it is said that a careful search failed to discover *anopheles* of any kind, but most of these stations are in the hills and the fevers met with there were ascribed for the most part to importation. There are not a few references to the fact or probability of importation by men arriving from some endemic centre, and this tends to vitiate, to some extent, the deductions based on the returns as to the exact geographical distribution of the disease. For the rest, it may be noted that the microscope was used as an aid to diagnosis in a minority only of the stations, and the results are not always stated. The practical measures adopted were, for the most part, the improvement of surface drainage, the removal of standing collections of water in and around cantonments, the use of kerosine oil as a larvicide; in brief, the measures advocated by Ross. In a few cases, mention is made of the use of mosquito-curtains for malarial patients in hospital and for the men in barracks; in other instances the provision of nets has had to encounter the opposition of the men on account of the alleged defective perflation of air their use involves. The administration of quinine as a prophylactic was very generally adopted during the height of the fever season and care was taken, as a rule, to ensure its ingestion by the men under proper supervision. But it can scarcely be said that this measure has had a thoroughly systematic trial; the dose, the interval between doses, the method and the period of administration have varied in almost every instance and very few medical officers have committed themselves to an opinion of its value. A discussion of the subject of preventive measures in cantonments will be found under General Remarks, page 122.

It is quite possible that one may see in the reduction of the reported prevalence of so-called remittent fever in 1903, one result of a more careful effort to differentiate

this anomalous class on etiological grounds; when specific parasites are demonstrated in the blood more regard may be paid to their etiological significance than to the vagaries of the temperature chart and of the clinical symptoms. At any rate the fact stands that while the admission and death rates for India for the quinquennium 1896-1900 were 19 and ·34 per 1,000, and for 1902, 6·7 and ·20, they fell to 4 and ·14 per 1,000 respectively in the year under review. The difference in the last two years depends on the decrease in the Bengal and Punjab Commands where the rates have usually been highest, and with an increase in influenza and dengue, and no marked diminution as a whole in intermittent fever, the fact is at least worthy of notice. Medical officers, as a rule, include any remarks they may have to offer on this subject in the discussion of malarial fevers; the term remittent fever is generally held to include cases that run a somewhat anomalous and severer course and which are not subsequently found to develop a recognisable specific entity apart from malaria. The season of maximum prevalence for India as a whole is generally fairly identical for intermittent and remittent fevers, but in the different commands and geographical groups there are considerable divergencies in the monthly incidence of the two classes. When autopsies are made the chief care is to exclude enteric fever, which may have been overlooked during life. The Punjab Command as a whole usually occupies the highest place on the list and this is the case in 1903; but the stations with the highest rates were Port Blair, where the strength is very small, Barrackpore, Nasirabad, and Maymyo.

The suggestion made above as to a cause of the diminution in the returns of remittent fever, may appear less plausible when it is noted that there has been an increase in the simple continued fever rate as compared with 1902, viz., from 14 to 18·5 per 1,000, but for this again the rate for the quinquennium ending 1900 was 35·4. This disease is remarkable for its large fluctuations in the returns, but they do not exhibit any regular relation, direct or inverse, with the remittent fever rates. The maximum seasonal prevalence is usually coincident with the height of the hot weather or with the onset of the first rain of the monsoon, the latter a time of considerable range and sudden falls in temperature; attacks are commonly attributed to chills and exposure to sun and heat, and may be largely due to lack of adequate physiological adjustment, or to malarial relapses. The Madras and Bombay Command rates have been highest in recent years, but in 1903 the Bengal and Punjab Commands stand first and show a considerable rise over the rates of the previous year. As regards geographical groups the incidence in 1903 was markedly highest on Gangetic Plain and Chutia Nagpur (V) and Indus Valley and Frontier (VII). As regards stations, by far the largest number of cases was treated at Mooltan and Lucknow, but the question of the etiology is not discussed by the medical officers concerned.

There were nine cases recorded as due to Malta fever, without a fatality, against eight admissions with one death in 1902; the reporting stations were Allahabad (4), Rawal Pindi (2), Khyragalli, Peshawar and Quetta one case each. None of the patients appear to have been stationed in any Mediterranean port, and the diagnosis, which was suggested on somewhat slender clinical grounds, was held to be established by the serum test, and, as regards this, particulars of the origin and history of the micrococcus employed are wanting, and in only three cases is the dilution mentioned, viz., 1 in 80. It is noteworthy also that of the five stations from which cases were reported in the previous year, only one, Rawal Pindi, appears in this year's list. Further, it does not appear that any attempt has yet been made in India to isolate the specific micrococcus. One can only conclude that, so far, the evidence is not sufficiently weighty for a positive diagnosis, more especially in the light of the recent observations of Konrich in Berlin. Working with cultures obtained from Wright (Netley) and Eyre (Guy's Hospital) he obtained complete agglutination in one hour, with the serum of hospital patients in different dilutions up to as high as 1 : 500; some of these patients had been treated with tuberculin, but the serum of others, who had not been so treated, reacted as markedly, and none of them had been exposed to any source of infection of Malta fever. The results further showed the greatest variations in the reactions of different races of the microbe to the same "normal" serum, which would agglutinate one race at 1:20 and others in different dilutions up to 1:500. Again, Captain Cornwall, I.M.S., has tested the reaction of the serum of certain healthy individuals as well as of some patients suffering from long-continued, ill-defined forms of fever with a culture of the micrococcus sent to him at Madras from the Pasteur Institute,

Kasauli. Among the persons in good health he found five out of six Hindus whose serum gave a "partial" reaction at 1 : 20, and in two of these cases there was also a partial reaction at 1 : 100; the serum of three healthy Europeans gave no reaction. Among the patients, the symptoms of none of whom suggested Malta fever, there were some whose serum reacted completely in dilutions of 1 : 80, and in three cases there was a partial reaction at 1 : 400. It would, therefore, appear that a "positive" reaction in dilution of 1 : 80 cannot be held to be pathognomonic of Malta fever, and that the serum of patients suffering from other diseases may give misleading indications.

Enteric Fever.—The literature in which are set forth the results of the work accomplished during the past year towards the elucidation of the problems of the etiology, diagnosis and prevention of enteric fever, is, as usual, enormous in amount and unusually extensive in its range. If it cannot be said to include any single contribution which alters fundamentally our conception of the disease, it, nevertheless, leaves the impression of a definite advance in the co-ordination of independent efforts under the influence of a clearer and more consistent view of the whole subject from the epidemiological side. Much of the constantly accumulating sum of knowledge has been confirmed by the test of fresh experience, by the wider application of more exact methods of research and by the recognition of the limits of the value of some of these methods. While the effective etiological factor has lost something of its specific unity owing to the recognition of the pathogenicity of organisms of the paratyphoid class, and while the uses and limitations of the Widal reaction in clinical diagnosis have been more strictly defined, the results have been rather to demonstrate the improvement in technique and in reliability of the methods at our disposal than to confuse the main practical issues. There is, indeed, satisfactory evidence of a definite advance in our capacity to control the disease, provided always that the resources in skill and laboratory equipment are available, and the gain may be said to consist in this, that we now realize what, previously, we knew, namely, that enteric fever is preventible by direct measures of attack and not merely as the result of general measures of sanitation.

To this end several factors have contributed, but no one more than the recognition of the prime importance of the human host as the source of infection. The danger to the community of the patient exhibiting all the typical signs of the disease has not always been duly recognised, and still less, or not at all, that arising from unrecognised cases presenting an aberrant clinical picture, or from light and ambulant cases, from convalescents and from individuals who may harbour and excrete the bacillus while giving no evidence of impaired health. And it is chiefly to Koch that we owe it that our eyes have been opened to the facts in these respects, while he and his followers have demonstrated the practical application of the measures thereby indicated. A full account of Koch's views and methods for the suppression of enteric fever in the endemic form in rural areas was given in this report for last year, and it will only be necessary here to note in its place the more recent evidence, in the course of a brief review of the more important contributions of other workers on the various aspects of the whole subject. It is perhaps not unnecessary to affirm that the problem is after all one, though indeed it has many sides, and that danger may lie in a too exclusive view of any one etiological factor. There has been some tendency to understand Koch to deny, or at least to underrate greatly, the *rôle* of drinking-water in infection, but this is scarcely justified. His view rather appears to be, that while water can and does convey the infection, the viability of the bacillus in water, and as a saprophyte generally, has been over-rated, and that the old exclusive water-borne theory has led to concentration of effort in a direction which has, on the whole, not been justified by results: and while he emphasises the necessity of all measures of conservancy in regard to water and removal of excreta, he would alter the chief point of attack when an outbreak occurs and in the suppression of the disease in an endemic form.

A considerable body of influential testimony is accumulating in favour of this standpoint. It is evident in the remarks made by several authorities in the discussion at the Epidemiological Society, of the paper by Dr. Reineke on the epidemiology of cholera and enteric fever in Hamburg and its suburbs, and still more clearly and concisely in the conclusions in which Pistor, in an address to the same society, sums up the lessons of the course and distribution of the disease in Prussia during the decade 1892-1901. Briefly it comes to this, that the *bacillus typhosus* has a much

shorter existence outside the body than has been commonly supposed, that it does not multiply in the soil, but is transferred from one person to another by means of water, milk, vegetables, or other food articles recently contaminated by the excreta of affected individuals, and also by direct contact; epidemics are, as a rule, due to infection of common water and milk supplies; mild unrecognised cases play a most important part in maintaining a chain of infection through successive sporadic cases, while over-crowding and general neglect of sanitation favour its propagation and extension.

Koch and Pistor alike arrive at this position, as the result of the study of the disease for the most part outside the chief urban centres, but very similar testimony is forthcoming from the great European capitals. Dr. Newman, M.O.H., Finsbury, sets forth the evidence for a large and typical London borough with undeniable force, and Doenitz, from the experience of Berlin, shows how manifold are the indirect sources and the vehicles of infection in a densely crowded city; and consequently, while the suppression of an outbreak on Koch's principles would encounter greater difficulties than in a circumscribed rural area, the measures based thereon are the more necessary to prevent extension from each focus of infection, *i.e.*, by suppression of infection at its source. With regard to the materials at our disposal for a judgment of the methods employed and the results obtained on these lines, we have the most interesting and detailed account given by Von Drigalski of the operations in Saarbruck, where a bacteriological institute was established from which, as a centre, a small laboratory and staff was mobilized for work in any specially affected locality of the area of the campaign; similar arrangements were made in Treves, Metz, Strasburg and Landau. With these resources, it was possible to make a thorough survey of the locality, the essential point of departure being the discovery of all cases of infection, whether in the obviously sick, in convalescents or in the apparently healthy; it remained to carry out measures of isolation and disinfection, preferably in a hospital, until repeated bacteriological observations had justified belief in the absence of infection. The author discusses the means at disposal for the detection of cases, and while endorsing the value of the Widal reaction, affirms that its true function is to serve as an auxiliary and confirmation of the clinical and epidemiological indications. It tells us nothing of the state of infectivity, and so of the public danger of a case, and moreover, as clinical signs frequently fail or mislead, the main resource must be the systematic bacterioscopic examination of the blood and excreta of the sick and of those in contact with them. Details are given of the methods employed and particularly of the selective culture medium first introduced by the author and Conradi, to which reference has been made in this report for 1901, and which it would appear, from this and other independent testimony, has fairly established its claim as a speedy and reliable process, which may be said to hold the field, at present, among its many rivals (see below). The author is by no means concerned to deny the *rôle* of drinking-water in spreading infection, and gives details of an outbreak in which both water and contact-infection operated in mutual dependence; and here again, suppression was achieved by attacking the sources of infection in man after closing the implicated water-supply. Finally, as regards the phenomena of so-called "Typhoid houses," where infection persists, the facts, when closely analysed, are to be explained less on an assumption of the viability of the bacillus in the soil, and outside the body, though the bad hygienic conditions common to such houses may lend colour to that hypothesis, than by a chain of infection maintained from man to man. And this is supported by the facts of the almost universal distribution of the bacillus in the organs and blood of the sick—a septicæmia—which involves its presence in most of the secretions and excretions, and with this the well-established evidence of the infection of healthy contacts, and the important *rôle* of unrecognised cases and convalescents in spreading the disease. This gives but a bare summary of a paper which deserves careful study for the scientific evidence on which the conclusions are based, the practical importance of which should justify this extended reference.

As regards the operations conducted by Professor Frosch in the villages round Treves, we have the independent testimony of Talayrach, which agrees in all essentials with that of Drigalski. Infection by water was excluded on the epidemiological and other evidence, which, on the first examination, seemed to indicate no obvious connexion between the notified cases, but by consultation of the registers of absentees from school, of the sick-clubs and of public health, by testing the blood of each case of illness by the Widal reaction and by the bacteriological examination of their

excreta, a continuous chain of infection was established between the cases. Here, again, it is said that the measures, based on the proof of "contact" infection, were crowned with success. A very similar report is given by Nœtel of an epidemic in Beuthen, in seven localities of which with an aggregate population of 65,000, 927 cases with 84 fatalities occurred in May and July 1900. There were two explosive outbreaks with a month's interval between them, and this suggested forcibly the influence of water or some other common source of infection; but this view had to be abandoned on the evidence, which, with the experience gained during the operations for suppression, was held to substantiate the contact theory, immediate or mediate, by means of contaminated privies and soil. Altogether, the lesson conveyed by these examples is that of the necessity of the training and discipline of our forces, and then of a well-directed attack upon the certain sources of infection, rather than a dissipation of effort in attempts to suppress the bacillus in the environment which are so often fruitless. Finally, some support to this view is afforded from another side in an account by Conradi of an epidemic of dysentery in the environs of Metz, the outbreak presenting all the now familiar phenomena of "contact" infection and necessitating similar measures for its suppression.

Enteric Fever: The Bacilli in Blood, Urine, Fæces, Sputum, &c.—In direct connexion with the human host as the chief source of infection, stands the distribution of the bacillus in the body, and also its means of exit therefrom. Drigalski lays stress on the view of the disease as a "bacteriæmia" rather than a local intestinal affection; post-mortem the bacillus is found in all tissues and organs, and in greater abundance as one ascends from the large intestine and the abdominal organs to the mouth, and thus all secretions and excretions may be expected to contain it in greater or less amount. This gives the key to anomalous and misleading cases which assume the clinical features of other diseases, *e.g.*, bronchopneumonia, bronchitis, influenza, &c. An elaborate paper by Bezançon and Philibert on extra-intestinal forms of Eberthian infection presents a considerable body of evidence on this subject, and there is an increasing number of isolated cases reported in which the bacillus was isolated from the sputum, from the pleuritic effusion and other pathological secretions in which the diagnosis of enteric was not at first entertained. When we came to the presence of the bacilli in the blood, the urine and fæces of persons in one or other of the active stages of the disease we are on familiar ground, and the evidence of the danger of the two chief excreta of convalescents and of light or ambulant cases is also incontrovertible. It is even pointed out by Velich that sudden death in times of epidemic prevalence may be the first obvious sign of the disease, and this is only an indication of many cases which altogether escape recognition and which are a great danger to the community as sources of infection which cannot be traced. Biffi and Galli, in order to ascertain if light cases of enteric ("*typhus levis*") were etiologically one with the typical infection, performed puncture of the spleen on 30 cases with the result that the fluid obtained was sterile in 2 cases, but in 27 others the true bacillus of Eberth was demonstrated. This outline of the essential facts, which have such an important epidemiological bearing, scarcely needs to be filled in here with a detailed *résumé* of the literally enormous number of accounts of work by observers in nearly all parts of the world, with the object of demonstrating the presence of the bacillus in the blood, the urine and the fæces. Year by year the salient facts have been recorded in the successive issues of this report, and the most recent work merely serves to confirm and extend them. Here it may be noted that in connexion with the ascertained limitations of the Widal reaction (see below) the early bacterioscopic examination of the blood is assuming a more prominent place in clinical diagnosis, and as an example of its value, confirmed by many similar statements, the results of Coleman and Buxton may be cited. They examined the blood of 604 cases, of which 23 were classed as paratyphoid, with positive results in 453 of the whole number; of 85 cases examined in the first week of the disease the results were positive in 79, or 93 per cent.; of 198 in the second week, 151 were positive, or 76 per cent.; of 115 in the third week, 66 were positive, or 56 per cent.; and of 55 in the fourth week, 18 were positive, or 32 per cent. In 10 per cent. of the total positive cases the results were obtained in advance of the Widal reaction. Some other workers report positive results along with the absence of Widal reaction in a considerable proportion of cases. The evidence, as a whole, goes to show that for successful bacillary diagnosis the blood is the best source in the earliest stages,

the urine in the later stages and in convalescence, while the fæces contain the bacilli in largest numbers during the second or third week of the disease, and in relapses. Drigalski affirms that he succeeded in demonstrating the germs in fæces several times as early as the second and third day of the illness, and we must look to the possibility of a still earlier excretion, even in the stage of incubation before the bacilli enter the lymphoid tissue. With these facts and probabilities before us it would be safe to assume for practical purposes that a person attacked by enteric is especially dangerous to others before and after he comes into the physician's hands. In regard to methods, a reference to the best approved culture media for examination of urine and fæces will be made in the next section, and the procedure for obtaining cultures from the blood was noticed in this report for last year.

Enteric Fever: Water, Food, Bacillary Diagnosis.—If we look next to the evidence which tends to substantiate the propagative *rôle* of drinking-water, it is not necessarily to assert any antagonism with the views just enunciated, but to avoid the danger of the partial outlook. The experience of the past year has furnished some instances of water infection, which, both by the authority of the workers and the evidence they supply, leave little to be desired in conclusiveness. A good example may be cited in the report by Professor v. Jaksch and Dr. Rau of the demonstration of enteric bacilli in the water of the River Maldau and in the pipe-water of Prague in the spring of 1904, during an explosive outbreak of the disease which furnished cases spread throughout the city in the course of a few days. The account is noteworthy for the details of the methods employed and for the results which leave no doubt of the addition of one more well-authenticated case to the scanty records of scientifically demonstrated water infection. Specimens of the water in question were, in the first place, treated by the process of Hoffmann and Ficker, which consists, briefly, in transforming the water itself into a nutritive medium by the addition of a solution of nutrose, and then, in the addition of solutions of caffein and of crystal-violet (Höchst) with the object of hindering the growth of *b. coli*, while favouring, or, at any rate, not retarding, that of *b. typhosus*. After a few hours in the incubator, plates of the Drigalski-Conradi medium were inoculated with portions of the water thus prepared, and from colonies which gave the requisite indications, bacilli were obtained to which a complete series of critical tests were applied; these included Pfeiffer's phenomenon and the agglutination (1 in 5,000) of an authentic and independent strain of the enteric bacillus by the serum of a guinea-pig which had received an intravenous injection of an agar culture of the suspected water-bacillus, heated to 60° C. for half an hour. All tests yielded unequivocally positive results, with both river and pipe water, and the text of this research, which is clear and concise, will repay study, not only as the complement to that of Von Drigalski, but for the conspectus afforded of the most recent and approved methods. It appears probable that, in this much-vexed problem of bacillary diagnosis, the processes of Drigalski-Conradi and of Hoffmann-Ficker will establish their value as the most important recent contributions to our resources within their respective spheres. Criticism is not wanting, but they have not hitherto been impugned on essential points and it must always remain true that no process will avail without the requisite skill and judgment in its employment. And, doubtless, finality has not been attained; of the most recent attempts at improvement two fall to be noticed as promising to justify their authors' claims to some extent when used in the appropriate circumstances, viz., the malachite-green-agar of Lentz and Tietz, another selective medium which acts by retarding the growth of *b. coli* while favouring that of the enteric and paratyphoid classes (A and B), and secondly, the fuchsin-agar of Endo which differentiates the colonies of *b. coli* from those of *b. typhosus* by the property of acid production inherent in the former with resultant red colouration, while the latter remain colourless. These new media appear to have a sphere of usefulness in examinations of the stools, possibly as supplements or complements of the Drigalski-Conradi process; simultaneous comparative tests of all three have been carried out by independent observers, with results that confirm their value, but more experience is required for an estimate of their relative advantages.

With this exemplary case of Prague before us, it would be tedious, and scarcely profitable, to give details of half a dozen other more or less well-authenticated cases of water-borne infection, accounts of which have appeared during the past year. One of the most careful and exact pieces of work is that of Conradi, who appears

to have succeeded in demonstrating the bacilli in well water, their identification being established by a study of the morphological and cultural characters, by agglutination with specific serum, by the positive results of the Pfeiffer reaction, by their virulence for animals and by the specific protective action for those of an anti-typhoid serum. The epidemiological facts supported the bacillary diagnosis, and the account is noteworthy for a concise summary of the history of similar work and results. In a paper published three months later the same author gives some astonishing results of his experiments on the viability of *b. typhosus* in water, but this account lacks the precise detail which marked the former one, and by which alone an estimate of its value could be formed. Briefly, he affirms that when portions of a spleen from an enteric case were inserted in pipe water and kept at 37° C., the bacilli were recovered after 542 days; when sterile and distilled water were employed, the bacilli were recovered after 429 days. Control experiments with enteric cultures showed a viability extending to 420 days in pipe and in distilled water and to 30 days in sterile water. He notes a change in the biological properties of the organism, owing to its sojourn in water, as shown by the formation of a pellicle on the surface of broth when transferred to that medium, and to this change he attributes the difficulties encountered by others in demonstrating the bacillus in water. The briefest allusion to two outbreaks of the disease (in Riga and in Kingston, Canada) which were traced to the pollution of river-water may take the form of a reference to the original authorities, and finally, on this subject the reader may consult Professor Lorrain Smith's careful study of the etiology of enteric fever in Belfast, in which fæcal pollution of a catchment area is held, by a process of exclusive reasoning, to be the source of the specific contamination of a portion of the water-supply of the city.

Coming next to the recent accounts of alleged infection by food, such as raw vegetables (water-cress), oysters, mussels and fried fish, there is naturally little or nothing to be affirmed on the basis of bacterioscopic examination of the incriminated articles, and the case for a positive verdict rests almost entirely on circumstantial evidence and on a process of exclusion of other sources of infection. Reference has been made to the views of Pistor for Prussia, 1892-1901, of Doenitz for Berlin and of Newman for London, and the interim Report of the Royal Commission on Sewage Disposal, issued last January, is not only important in regard to the evidence of the extent of the mischief caused by sewage—contaminated shell-fish, but also for its discussion of the vexed question of the bacillary criterion of specifically polluted water. McWeeney's report to the Local Government Board, Ireland, is a valuable contribution to the same subject. The general conclusion of the work and opinions of the best authorities may be stated as follows: " mere numbers of *b. coli* or any other particular micro-organism of sewage cannot be said to have anything approaching an exact value as an indicator of the danger of disease " from shell-fish. Klein " would not reject oysters as polluted with human sewage on account of the purely bacteriological examination " yielding *b. coli*, and he emphasises the paramount necessity of a topographical survey for the formation of a judgment! and here the matter rests, for the present, with the declaration that further research is necessary. There is, however, something more definite in the statement made by the medical officer of the port of London in his report for 1903, that cockles, which had lain in Leigh creek, Essex, to which the effluent from " biological " sewage beds has access, were found by Klein to contain the typhoid bacillus, or at any rate, a bacillus answering to all the tests of the *b. typhosus*. It is significant that an independent local medical authority had previously suggested that cases of enteric within his jurisdiction were probably due to the consumption of cockles from Leigh.

It may be noted here, in connexion with the contamination of food and as having a direct bearing on the previous discussion of contact infection, that Winslow reports having examined, bacteriologically, the hands of 111 persons, chiefly students and professors, and that of this number ten proved to harbour *b. coli;* the hands were immersed in sterile water and portions of this were subsequently cultivated on the ordinary media. With regard to milk, nothing demanding special notice has been reported since Schüder's discussion of the subject and Bruck's experimental work on the artificial infection of milk, butter and cheese, both of which were noticed last year. A small outbreak of enteric at Tregantle Fort, Plymouth, was considered to have arisen from contamination of the milk at a farm, the proprietor of which was the local contractor for the removal of sewage, and he appears to have used the close neighbourhood of the dairy as a dumping ground for fæcal excreta.

Enteric Fever: Clothing, Soil, Dust, Flies.—The medical officer of the Port of London (Report, 1903) gives a detailed account of the conveyance of the disease to the port by infected blankets from the field of war in South Africa, a matter which, in another connexion, received notice in this place last year. The danger of the contamination of boots by foul soil and in foul privies, &c., must also be borne in mind, especially for those who have to clean these articles. Doenitz, from the experience of Berlin, notes the tracing of infection to soiled bedding and clothing.

The risk which children run of infection from their habit of playing on the bare soil and of applying their hands to their mouths has been suggested, notably by Koch and his followers, and those in contact with them may often thus derive the disease.

Those who hold by the theory of dust-borne infection are still deriving their evidence and conclusions chiefly from the experience of the South African war, *e.g.*, Tooth and Caldwell. With regard to the question of the *rôle* of flies as disseminators of the disease, Austen gives a summary of the evidence which has accumulated during the last few years, based chiefly on the experience of recent campaigns, and on experiments which have been noticed in previous issues of this report. He then reviews the characteristics, life-history and general binomics of the commonest latrine-haunting species, noting that one, the "house-fly," is as common in India as in South Africa. As to the practical issues, he says that it is not sufficient to insist upon the necessity of promptly burying all refuse, horse-dung, offal, &c., in which flies may breed, of the disinfection of latrines and the effective use of dry earth therein. What is required is some simple means, adapted to service conditions, of preventing the access of the fly to the latrine for however short a visit, and he suggests the employment on latrine trenches of light metal covers, which should be provided with apertures closed by spring flaps, to be operated by the feet of the users.

Hamilton gives an account of some experiments made with flies caught in infected houses and their surroundings during an epidemic in Chicago in 1902; in five out of 18 cases the results of cultures, on media contaminated by these flies, were successful in the recovery of the *b. typhosus*, and altogether 12 different micro-organisms, mostly of the *coli* group, were isolated.

Enteric Fever: Paratyphoid Fever and the Agglutination Test.—The extended application of biological reactions in diagnosis has led to the attempt to differentiate on the etiological side the large group of cases of the enteric class which on clinical grounds were formerly held to represent one pathological state. Hints to this end were furnished by the so-called light, aberrant and abortive cases of enteric fever, and also by the modifications in the pathological lesions found post-mortem; but it is chiefly owing to the development of the technique of the bloom-serum reaction and of our knowledge of its true value and limitations, as also to improvements in methods of bacillary diagnosis, that we are now able to distinguish between true enteric fever due to the bacillus of Eberth and a class of clinically more or less similar fevers, the effective agents of which belong to a series of floral forms intermediate between *b. typhosus* and *b. coli*. One by one these forms have been isolated and their morphological and biological characters studied comparatively, and endeavours have been made to classify them more or less definitely, if provisionally.

It is impossible to discuss this side of the question in detail in this place, but it may be said that so far the whole series may apparently be included in one or other of the following groups, viz. (*a*) organisms of meat poisoning, the bacilli of Gärtner, Basenau, Fischer, Cotta and others; (*b*) those which give rise to an obscure form of pneumonia in man and to disease in parrots, *b. psittacosis;* (*c*) those apparently non-pathogenic to man, *b. typhi murium* (Löffler); (*d*) the paratyphoid group, represented by several members, with more or less close affinities and at present described by the names of their first observers.

These last present certain minor biological differences among themselves, and in virtue of these they have been provisionally divided into two classes, A and B, the former of which approximates, in most respects, more nearly to *b. typhosus*, and the latter to *b. coli*. In regard to their distribution in the tissues and organs of the infected and in the excreta, they are as abundant and widespread as in the case of true enteric which in these respects they closely simulate, and for their isolation and identification precisely similar methods are in use. As regards the serum reaction for clinical diagnosis, the bacilli isolated may be tested, on the one

hand, with an authentic human or animal paratyphoid serum, and, on the other hand, the serum of a doubtful case should be tested with authentic strains of *b. typhosus* and the different members of the paratyphoid class. The weight of evidence, which is abundant and daily accumulating, goes to show that while paratyphoid serum will often agglutinate *b. typhosus* it always acts upon the paratyphoid bacillus, which is in causal connexion with the attack, in very much higher dilutions, a distinction most marked at the height of the disease. The pathological results of infection are, as a rule, conformable to the clinical effects; that is to say, the picture may frequently stand for an ordinary case of true enteric, but, as a rule, there are modifications due to the absence of one or other typical feature of the latter, *e.g.*, a lack of the classic lesions of the small intestine and mesenteric glands, while the tendency to pneumonic complications, to hæmorrhages and to pyæmic deposits is perhaps more marked.

It is also notable that there is frequently local reaction and ulceration in the upper parts of the large intestine, so that, roughly, one may perhaps distinguish a tendency to a bridging of the interval between the pathological *facies* of enteric and dysentery, the causal agent of which last has certain biological affinities with the whole group under discussion. On the epidemiological side the chief points of interest are the persistence of the bacilli in the excreta of convalescents; the fact, now established on good evidence that some, at least, of the organisms can maintain their viability in water and in milk and meat (and one sub-class, as we have seen, is specially associated with meat poisoning outbreaks), and also the tendency of the disease to appear in relatively small epidemics. Lastly, a good many cases of mixed infection have been described, the paratyphoid organism being found in conjunction with the influenza bacillus, with streptococcus and with true *typhosus*. The best and most reliable example of the last is a case described by Conradi, who affirms that to prove mixed infection it is necessary to demonstrate both organisms, not only in the body of the sick but also in the medium of infection, as he appears to have succeeded in doing.

Beyond the intrinsic practical interest of the subject, for a general discussion of which the reader may refer to papers by Clemens, Kayser, Firth, Fischer and Drigalski, the work here summarized derives a special interest and value from its bearing on the problems of serum agglutination. The discovery of the reaction commonly associated with the name of Widal was hailed at first with extravagant hopes, from which there have since been signs of reaction, owing undoubtedly to lack of precise knowledge of the bio-chemical forces in operation, and to a too exclusive reliance on its indications apart from a consideration of the whole clinical and pathological evidence, and frequently in the absence of supplementary bacterioscopic research. It is on this account that the summary just given of the present position of opinion on the paratyphoid question must be received with a certain reserve, for it is based very largely on the results of a single test, which, in some respects, has proved itself to possess only a relative value for clinical diagnosis. It is not denied by any competent authority that it is certainly a valuable aid to diagnosis, that it is, indeed, indispensable, and it may well prove that as knowledge grows, we may see in its very limitations surer evidence of its true worth. Failure has often been the result of haphazard methods and a lack of appreciation of the obscure differences that mark different strains of the same organism obtained from different sources and kept up under varying conditions in the laboratory; and similar variations of a bio-chemical nature have to be regarded in the reaction of the tissues of the organism which provide the conditions for agglutination. The difficulty in obscure atypical cases is indeed threefold, for to the above we must add that of the personal equation of the observer, and what is essential is a judicious estimation of the reaction in the particular case in question, based on a critical survey of the whole evidence. This is enforced by the fact, which appears to be well established by Jürgens, Brion and Altschüler, and Stern in their studies of agglutination curves during the course of the disease, that maximum agglutination values may be given by the serum with bacilli which were shown to have no etiological relation to the illness, and further, that the specific agglutination value is not invariably above that of the group agglutination, which, indeed, cuts at the root of the *rationale* of the differentiation of paratyphoid and enteric fevers. While this gives pause to our acceptance of many published results and opinions, it does not indicate that we are at the end of our resources; such cases are relatively few, and apart from the effect on the serum reaction of mixed infection which may be in operation, it

is precisely herein that Castellani's procedure (exhaustion of the agglutinins) and Pfeiffer's phenomenon are available and probably conclusive. The conclusion we may draw is that, while in the laboratory we can more or less control the factors in operation, the problem of clinical diagnosis may be complicated by the individuality of the case; no single test or symptom can be relied on, but that of Widal will maintain its great value when its results are read in the light of the whole clinical and pathological syndromata, and beyond this, it will, in the great majority of cases, possess a relative value to the patient, the clinician, the epidemiologist by furnishing signs of specific infection, present or past. In using it, any idea of the indications of specificity from arbitrarily fixed dilutions must be abandoned; in each case the observer must exhaust the limits of the reaction of the serum on different micro-organisms of authentic identity and origin which may enter into possible etiological connexion with the case, and so refer not to "negative" or "positive" results but state the facts.

It would seem, also, that any simplification of the serum test, that does not involve loss in accuracy, would prove more profitable than an ever-increasing complexity of technique, with its tax on the judgment of the observer. And to this end, it would appear, from the unanimous consensus of a large and increasing number of reliable authorities who have used it in comparative tests with the ordinary Widal procedure, that Ficker's so-called "diagnosticum" has established its position. This appears to consist in a suspension of a culture of *b. typhosus*, killed by heat at about 58° C., in 10 per cent. solution of glycerine to which some carbolic acid or formalin is added. Along with the abundant and strong testimony to its delicacy and reliability, often exceeding that of the ordinary test, it is recommended for its simplicity and its availability to the clinician in the absence of laboratory resources, and altogether specially adapted for work in military hospital practice.

Enteric Fever: Preventive Measures.—The preventive measures based on the foregoing considerations have already been indicated, but may be summarized briefly in this place. For an effective and systematic campaign against enteric fever we must take account of every possible mode of transmission and form of the disease, and this is especially the case where, as in India, we are unable to discover and control all sources of infection. While taking this view of the problem, which is indeed the problem of general sanitation, it is obvious that as we stand at present, with the disease actually confronting us, the most effective line of action will be to endeavour to prevent the dissemination of the infection from its sources in the human body, while, as far as possible, guarding against the more general and problematic avenues of infection in the environment. As regards the first object, the guiding principle is the prompt recognition of all cases of infection, whether in the persons of the sick or of convalescents, while, at the same time, the special danger from light, ambulant cases and from apparently healthy contacts is not overlooked. To be effective, this work requires the devotion of skilled bacteriologists with laboratory resources, not only for technical diagnostic purposes, but also for local enquiries into the etiological problems involved, with a view to prevention, an aspect of the case which derives special importance in India from the absence of practitioners in the service of the civil population. With recognition must come prompt isolation of the infected person, and disinfection and proper disposal of all his excreta, and of all objects in contact with him, throughout the course of the infection and until there is reasonable evidence of its termination. Disinfection of the home or place previously occupied by the case is also essential, and it may be necessary to secure this by its evacuation for a definite period. Attendants and others in contact with the case must be instructed in measures of personal disinfection, and previous contacts must be carefully watched for signs of infection. Communication must be cut off with places of common resort, *e.g.*, latrines, refectories, &c., and with other localities, cantonments, &c., as far as those who may reasonably be deemed infected, or possibly infected, are concerned. In the case of a fatal event, the strictest sanitary precautions must be taken for the safe disposal of the corpse. For the rest we must look to the strict supervision and control of the food and water-supplies and to conservancy as regards the prompt and effective disposal of sewage and other refuse. Under the peculiar conditions of the European soldier's life in India, we are not at present justified in hoping that the most effective measures of suppression will result in complete prevention, and there can be no

question of the great value to the individual and to the State of an effective means of prophylaxis by "inoculation," and with this, the promotion of all measures calculated to facilitate the physiological adjustment of the young Briton to the strange and trying conditions of the new environment, during the first year of service therein. It is understood that Dr. Wright's anti-typhoid inoculation process, which has been commended by a Committee of the Royal College of Physicians, is to be further submitted to the examination of a body of experts under the auspices of the Army Council and a definite pronouncement on the various questions involved may shortly be expected. Work on this subject has been reported during the year by Shiga, Wassermann, and Bassenge, and Rimpau, and Wright has given a clear and full account of his methods and results, which affords an admirable *résumé* of the scientific basis of the procedure.

Opinions of Medical Officers.—Turning now to the experience and work in India during 1903, we find that medical officers, who see most of the disease at close quarters, have little definite evidence of a direct kind to offer for the solution of the problems of the particular outbreaks they had to deal with. In no single instance can it be said that the source of infection was conclusively traced, but in their accounts of the local conditions and of the circumstances attending the occurrence and course of the disease there is certainly no lack of evidence of the operation of all the etiological factors we are led to associate therewith. There is the usual reference to the youth of the men and to their special liability during the first period of service in the country, and beyond this, opinion appears to be unequally divided as to the relative importance of the conditions which determine the risk and actual acquirement of infection. The general tendency is still to look to the bazaars, villages, and to the environment beyond cantonment limits as the pre-eminent foci of danger. In default of more direct evidence, it is most commonly assumed that infection was derived from articles of food and drink consumed in, or obtained from, native bazaar dealers, or while travelling to join their regiments, or on the line of march between cantonments. As regards the last contingency, the hill stations afford abundant and indubitable evidence of importation, though it is not always clearly demonstrated that the disease was acquired *en route*, rather than from the cantonment of departure. There can be little doubt, however, that direct importation from one infected cantonment to another is a frequent occurrence and a very real danger. The medical officers of more than forty stations refer to importation as the source of part or the whole of the disease with which they were concerned, sometimes as introduced by new drafts from home, or as carried by the men from the plains to the hills, in which cases, convalescents are sometimes implicated, or reversely, introduced into cantonments in the plains by men returning from hill stations in the autumn, or, lastly, by transfers in the plains. It is impossible to ignore the fact that wherever originally derived, many stations constitute endemic foci, which are a potent source of infection for the inhabitants and for men on first arrival, and of danger by dissemination to other places by the constant movements described. These circumstances lend importance to a growing body of opinion, for which the reports of the last few years are notable, which would point rather to the sources of infection within cantonments; stress is laid, and not unduly, on the defective methods of conservancy that prevail, on the improper structure of latrines and urinals and on the very inadequate methods of removal and disposal of excreta. The careless habits of the men, the plagues of flies and dust which are regularly recurrent phenomena in the majority of stations, and the difficulties experienced in protecting food and water from contamination, all derive their importance from this common source of danger. It is notable that one or other aspect of this view is emphasised in the reports for 1903 on the outbreaks in eleven of the chief endemic centres,* where 54 per cent. of the total number of cases occurred, and this does not include all the minor references to the subject. In the light of the work which has recently been accomplished in connexion with the etiology of the disease, these considerations acquire the greatest force; a too ready acquiescence in an exclusive view of sources of infection from outside must lead to lack of concentration of effort for the reform of insanitary conditions with which the men are in constant and immediate touch. The first step in the application

* In Umballa, Meerut, Lucknow, Nasirabad, Mhow, Poona, Rawal Pindi, Peshawar, Bangalore, Jhansi, and Kamptee.

of the principles, which are established by the facts previously summarised, must be in this direction, as striking at the root of the chain of infection.

For the rest, the records travel over familiar ground; the medical officer, as a rule, has to confess himself at a loss for conclusive evidence of the actual origin and means of infection, and so falls back on an enumeration of possible or probable sources, or, by process of exclusion, arrives at one or other most probable source for the case in question. In at least nine stations the drinking-water was reported to be open to suspicion, or was even condemned as polluted, while in as many other instances, it was declared to be beyond reproach; the practice of boiling before issue is generally maintained, but the methods of storage and distribution do not invariably preclude the risk of contamination, and, indeed, sometimes promote it. The majority of the cases at Quetta were attributed to the drinking of water from unauthorised sources by men when on manœuvres, in camp, or on the march. Attacks were thought to be due to the consumption of milk purchased from the bazaar, in three or four cases only, and the exact evidence available for direct contact infection, as by attendance on patients in hospital, does not account for more than half a dozen. A few officers record their opinion of the danger of clothing and bedding which had been used by patients before admission to hospital and subsequently issued to others, and the provision of steam laundries in connexion with station hospitals is suggested. The proximity of native communities and the constant sources of infection provided by the traffic therewith is constantly referred to, and followers and servants who live in the lines are sometimes condemned, not only as importers of the virus from without, but as providing all the elements of danger in themselves and within the fold. It may be noted, finally, that the serum-test does not appear to be employed as a routine procedure in more than a minority of the stations, but among these are the chief endemic centres of the disease.

Enteric Fever in 1903.—The main facts concerning the extent and distribution of the disease during 1903 may now be summarised briefly. The admission-rate after having risen, with slight fluctuations, to the highest point (36·9 per 1,000) in 1898, fell rapidly and steadily during the next three years to 12·8 in 1901, the lowest point since 1885,* previous to which the completeness of the returns is open to serious doubt. In 1902 the tide returned and the rate of that year, 16·7, has been followed by one of 19·6, which, however, with the exception of the three previous years, is the lowest since 1890. These striking movements and the salient features of the rate-curve can be referred in the main, firstly, to the effects of the Frontier campaign (1897-98) on an army largely composed of men at the most susceptible ages, hence the enormous admission-rate of 1898; and, subsequently, to the marked modification in the human material exposed to risks in India, as the indirect result of the Boer war. From 1890 up to the winter of 1898-99, between 15,000 and 16,000 young men were imported into Indian cantonments every year; then for two years the numbers fell off to about one-fifth and one-third, respectively, of that average, and we see enteric fever at the low ebb. And lastly, with a return of the drafts in the last three years, in greater numbers than ever, the rates rise significantly, if not proportionately. The amount of susceptible *personnel* must always be a chief factor in determining the prevalence of the disease, provided that it is exposed to infection, and the final result will vary with the more or less effective interaction of both these factors. Notwithstanding the rise in the admission-rate, the mortality fell off slightly from 4·29 per 1,000 in 1902 to 4·19 in 1903; the case mortality was lower to the extent that in every 1,000 cases, 43 more men recovered in 1903 than in the previous year.

There were, in all, 1,384 cases reported, with 295 deaths, during 1903, as compared with 1,012 and 260, respectively, in 1902; the average duration of a case was 54·35 days and the average number of men constantly sick was 206·07, so that the total loss of service due to enteric fever alone, in 1903, was 75,216 days.

Enteric Fever in Commands and Geographical Groups.—The disease was more prevalent in all the Commands, those of Bombay and Bengal yielding the highest ratios. As regards the geographical groups, Central India (VIII), Upper Sub-Himalaya (VI), and Gangetic Plain (V) stood at the head of the list, all showing a considerable increase in their rates, as compared with 1902, and, as regards the

* It was 12·7 in 1887.

first two, with the corresponding decennial means. In these three groups, which may be considered to comprise the chief endemic area, there were 16 stations from which rates above 20 per 1,000 were reported, 11 stations with rates above 30, and 7 above 40 per 1,000. On the other hand Bengal Orissa (IV) and Western Coast (X) did not, together, furnish more than 3·3 cases per 1,000 of strength.

Enteric Fever in Stations.—From 29 stations rates of over 20 per 1,000 were returned, as was also the case in 1902, and among these the following may be noted, with their admission-rates per 1,000 :—

In Group VIII.		*In Group VI.*		*In Group V.*	
Nasirabad ...	121·8	Meerut	50·4	Dinapore... ...	42·7
Indore	52·6	Umballa	49·4	Lucknow ...	37·7
Mhow	48·0	Sialkot	32·6	Cawnpore ...	21·3
Neemuch ...	41·0	Delhi	23·5	Fyzabad	20·2
Jhansi	38·7	Rawal Pindi ...	23·0		
Nowgong ...	35·0	Roorkee	21·2		

The list also includes Peshawar (33·8) and Jubbulpore (42·1) lying just beyond the areas broadly indicated, and, in addition, eight hill stations. The special points of interest in connexion with all the more important outbreaks have been summarised in previous paragraphs.

Relation of Enteric Fever to age and length of residence in India.—In 1903, as in previous years, the greatest liability to suffer and die from enteric fever fell upon the age-period, 20 to 25, and upon the first year of Indian service; the extent of this liability may be estimated by the fact that the admissions for men up to 25 years of age, that is, on half the total strength, amounted to nearly 76 per cent. of the total admissions at all ages, and that nearly 74 per cent. of all cases occurred among men during their first two years of Indian service, *i.e.*, on 43 per cent. of the strength. A feature of the returns for the last five years, a period of comparatively diminished prevalence of the disease, is the noticeable tendency to a rise in the admission-rates for the higher age and service periods. For example, while only 0·2 per cent. of the total cases occurred among the men over 35 years of age, who formed 3 per cent. of the strength in the triennium 1896-98, the ratio rose to 0·48 on 4 per cent. of strength in 1899-1901, and further to 0·6 on 4 per cent. of strength in 1903. Again, while in 1896-98 5·4 per cent. of the total admissions were from men with five years' service and upwards, *i.e.*, on 18 per cent. of the strength, the ratio for the following triennium was 14 on 29 per cent. of strength, and for 1903 it was 11·6 on 23 per cent. of strength. That is to say that, comparing the last year with the first period, the incidence on the highest age-periods is nearly two and a half times as high, and that on the highest service periods is nearly twice as high. These results may be due partly to more accurate diagnosis, or, perhaps, to a diminution of the acquired immunity in the older men, owing, possibly, to decreased prevalence of the disease in Great Britain during recent years.

Plague and some other General Diseases.—With plague epidemic among the native civil population in far greater extent and amount than in previous years, it was to be expected that the number of casualties would rise among the troops located in proximity to the native communities affected. In 1901 there were two cases recorded with one death; in 1902, four cases with one death, and in 1903 the numbers were twelve and two respectively; but although the disease prevailed widely among the general public in every Command area, it was only in those of Madras and Bombay that the troops were attacked. Bangalore and Belgaum yielded one case each, one being fatal, and Poona, Ahmednagar, Kirkee, Mhow and Neemuch furnished altogether ten cases, with one death at Mhow, in which the disease took the pneumonic form. At all these places plague prevailed in epidemic form among natives, either in the bazaars or in the neighbouring towns, and in most cases evidence was forthcoming of actual contact with cases. There were altogether 20 admissions with two deaths from measles, the majority occurring at the two hill stations, Chaubuttia and Dagshai. To erysipelas were attributed 69 cases with two fatalities, the Bengal and Punjab Commands being chiefly affected. Out of the 26 admissions and six deaths from beri-beri, nine and three, respectively, were reported from Thayetmyo (Burma), and nine and two, respectively, from Aden.

In the former series, which followed on six cases in the previous year, peripheral neuritis and cardiac dilatation and embarrassment were the main symptoms, and the men who succumbed were "noted as large beer drinkers," but analysis of the beer for arsenic gave negative results. The Aden cases were associated with a larger number of admissions for multiple neuritis which are separately returned, the diagnosis of beri-beri apparently resting on the accompanying symptoms of disordered action of the heart, cardialgia and cyanosis, the men who died sinking suddenly with fatal syncope. The medical officer in charge is unable to throw any light on the cause of the disease. There were altogether 303 cases of dengue, or five in excess of the number in 1902; the disease was confined to three stations in the Madras Command, and to three in the Burma district, Fort St. George (Madras) with 82 cases, one fatal, Rangoon 151 cases, and Thayetmyo with 59 cases being the centres chiefly affected, as was the case, as regards the last two, in the previous year. The disease is said to have prevailed in epidemic form from May to August and to have been generally of a mild and ephemeral type, and as noted in this report for 1902, it was believed to have been imported into Burma by Chinese immigrants from Hong Kong. As regards the Madras cases, which occurred during the first six months of the year, the medical officer mentions the theory of importation from Rangoon, to discard it, in favour of his view of its endemicity in Fort St. George; during the outbreak among the troops many of civil residents in the city, both native and European, also suffered.

Mention has been made of the very considerable loss sustained by the invaliding of 158 men on account of *Bilharzia hæmatobia;* altogether 318 cases, with one death, were reported from 33 stations which are included in all four Commands and the Burma district. As regards 293 cases, it is definitely stated that the men had arrived from service in South Africa, but the reports do not indicate what interval, if any, elapsed between arrival in India and the detection of the disease, save in the instance of Deolali where 126 cases were received from South Africa as convalescents and none of these were invalided during the year. One case, admitted in Mian Mir, is important, as the medical officer attributes the infection to local origin. The man had never served in Africa, which, with Arabia, so far as is known at present, is the chief endemic home of the parasite,* but some three months previously another man of the same regiment, who had served in the Boer campaign, had been transferred to a hill station on account of the disease. No other cases occurred at Mian Mir, and it is said that the two men in question "had not been in contact in any way." However this may be, the future course of events must be watched with solicitude; it does not, however, necessarily follow that with the ova of the parasite scattered in many cantonments, the conditions for its development and propagation are present in India. Previous to 1902, when 51 cases were recorded, all, it is believed, due to importation from South Africa, the returns are blank in respect of the disease. Hatch has recorded several cases which he observed among natives in Bombay, chiefly Muhammadans who had made the pilgrimage to Mecca, and he remarks (1887) that "the disease appears to be more common than formerly," and on the evidence of one case, he suggests that the interval between infection and the onset of active symptoms may be something under eight weeks. Scheube affirms that Indian coolies from Madras and Bombay are not seldom attacked in Cape Colony, and as these emigrants are constantly returning to India they probably disseminate the ova in their home surroundings. Nevertheless, the disease is not, apparently, recognised among the indigenous native population, though it is true that only a small proportion of the sickness occurring outside the urban centres, comes under skilled observation.

Many medical officers took the precaution of incinerating the urine of these cases, a measure which should never be neglected, and should, of course, extend to the alvine dejecta. One case is reported where intestinal hæmorrhage together with a tumour in the rectum led to a suspicion of malignant disease, but the microscope revealed a mass of the ova in a matrix of mucous and fibrous tissue.

Tubercle of the Lungs.—There was no change in the admission-rate on account of tubercle of the lungs for the European army as a whole, and for three successive years it has stood at 3·4 per 1,000, while the corresponding death-rates were ·46, ·59 and ·24 per 1,000 respectively, the last being by far the lowest on record; this is

* Cases have also been observed in Mauritius, Syria, Cyprus, Mesopotamia, Penang; Shanghai; one case in North America and one acquired in the West Indies.—(*Scheube*).

due to a fairly equal diminution in the case mortality in all the Commands, save Madras, where the death-rate is generally lowest. On the record for the quinquennium, the Bengal Command stands out with the highest mortality for both European (·71) and native troops (1·10), and the province of Bengal occupies the same place in the Jail Statistics. But in the last two years, so far as the army is concerned, the Bombay Command has returned admission and death rates which are considerably above the average for the rest of India. This is probably due to the returns from Deolali, where men are received from all parts of India prior to their embarkation for home, and cannot be taken to represent any special incidence of the disease on the station or the Command. The death-rates of European troops, native troops, and prisoners during the year were in the proportions of 5, 14, and 81 respectively.

Pneumonia and other Respiratory Diseases.—In 1902 the admission and death rates from pneumonia were much above the average, being 5·9 and ·97 per 1,000 respectively, but they fell in 1903 to 4·6 and ·57, the corresponding decennial means (1893-1902) being 4·2 and ·64 per 1,000. The more favourable results were almost entirely due to the diminution of the disease, and especially of the case mortality, in the Punjab Command, where, as a rule, the incidence is highest, and the Upper Sub-Himalaya group (VI) takes the first place this year as in the previous one. Attock Cantonment, where the range of temperature is very great and the winter temperature very low, furnishes rates this year of 35·7 and 8·93 per 1,000, which are unequalled in any other station. For the country as a whole the months of maximum prevalence were January and February, while fewest cases occurred in July, August and September. It may be noted, for comparison with the decennial means given above, that the corresponding rates for native troops were, admissions 14·7, and deaths 3·31 per 1,000, that is, three and a half and five times greater, respectively.

There was a slight decrease in the admission-rate from other respiratory diseases as compared with the previous year, viz., 20·5 against 22·5 per 1,000, the corresponding death-rates being ·21 and ·25 per 1,000, and here again it is the decrease in the Punjab Command which accounts for the difference. As regards the geographical groups, Burma Coast (I) and Bengal-Orissa (IV), where influenza was at its worst, yielded the largest number of cases in proportion to strength, and the stations to which this statement applies were Sitabaldi, Rangoon, Shwebo, Poonamallee and Kasauli, all with admission-rates above 50 per 1,000.

Dysentery and Diarrhœa.—There has recently been a steady diminution in the admission-rates on account of dysentery; the mean for the period 1896-1900 was 30·7 per 1,000, and this has fallen in the three succeeding years to 21·3, 20·4 and 16·9 respectively, the corresponding death-rates ranging from 1·10 for the quinquennium quoted to ·70 in the year under review. The Burma district in 1903 takes the highest place, which is usually occupied by the Bengal Command, while the Punjab has the lowest admission-rate, and Bombay the lowest death-rate. The table on page 40 will afford the best view of the contrasts in the incidence on the different geographical groups. As a rule, the disease is most prevalent during the height of the monsoon rains, but this year the maximum incidence tended towards the drier months, in Bengal, April, in Madras, May, June, and July, in Bombay, August and October, and in the Punjab, December. Barrackpore (151·1) and Poonamallee (120·6) had the largest number of cases in proportion to strength, and Rangoon and Naini Tal reported the highest death-rates, 9·6 and 7·04 per 1,000 respectively. At Barrackpore, which has a most unenviable reputation for the disease as well as for abscess of the liver, there has been a marked decrease during the past two years, but to judge from the special report of the Sanitary Officer (Major Aldridge, R.A.M.C.), much remains to be done on the lines laid down in previous paragraphs for the prevention of enteric fever, before hope of a permanent reduction can be entertained. At Rangoon the results were attributed chiefly to the youth and carelessness of the new arrivals, especially band boys, and to the impure food and milk indulged in.

The admissions on account of diarrhœa in 1903 yielded a rate per 1,000 of 13·5, as compared with 12·9 in the previous year, but no fatality was recorded. There is no great difference in the incidence of the disease on separate Commands, the Punjab taking the highest place, but as regards the geographical groups, Burma Coast (I) and the hill stations (XII *a*, XII *b*) have far higher rates than all the

rest. In the last named are included the stations with the highest ratios, viz., Ranikhet (71·3), Naini Tal (70·4) and Kasauli (64·8).

Hepatic abscess.—In 1902 the sickness and mortality from abscess of the liver were above the average as represented by the means for the quinquennium (1896-1900), viz., 2·3 and 1·36 per 1,000 respectively, but in 1903 there is a return in the right direction, rates of 2·4 and 1·29 being recorded. The Bengal Command, as usual, and its constituent geographical groups (IV and VIII) stand apart at the head of the list, and the stations most severely affected in proportion to strength were Barrackpore and Naini Tal, as was the case in the previous year. Allusion has been made to the excessive prevalence of dysentery in both these cantonments, and the connexion of the two diseases is notified in the majority of the cases of liver abscess reported this year, or, more exactly, in 71 per cent. of those occurring in the chief endemic centres. The type of dysentery prevailing at Barrackpore is said to be the "amœbic," and the medical officer reports that the "*Amœba dysenteriæ*" was found in the pus of all but one of his cases. Having regard to Schaudinn's work on the differentiation of the "*Entamœbæ*," one could have wished for a more definite and detailed description of the parasite recovered in these cases of both dysentery and abscess. Dinapore, Agra and Indore may also be mentioned as being affected in excess of the average, and it may be added that where fuller results of post-mortem examinations are reported, multiple abscesses were found in a majority of the fatal cases.

Alcoholism.—There were five deaths from alcoholism in 1903, against eleven deaths in each of the two previous years; the average number recorded annually during the decennium ending 1900 was seven, so that the figure for the year shows an improvement.

Venereal Diseases.—The admission-rate for all classes of venereal disease in India in 1903 was 247 per 1,000 of strength, against 281·4 in the previous year and 276 in 1901, and one must go back 24 years (to 1879) to find a lower rate than that of the year under review. The slight rise in the rate of 1902 was therefore only a temporary break in the phenomenal and consistent diminution which the records exhibit since 1895, when these diseases attained their maximum prevalence in the returns, viz., 522·3 per 1,000. The causes of this reduction of the rate by more than half its amount during the last eight years are various, and many of them are not obscure, if, however, it be impossible to appraise their relative values. Up to 1895, one effect of the short service enlistment was to introduce a large number of young men into Indian cantonments every year with all the consequences resulting from freedom from a sense of personal responsibility and ample opportunities for indulging their imperious impulses; then for about ten years before the date mentioned the lock-hospital system had been abolished, and in view of the state of medical opinion at the time, this doubtless resulted in a sense of helplessness on the part of the authorities, medical and other, in face of the situation thus created. There was perhaps some lack of adaptation of resources to meet it and possibly treatment of infected men, as of course of the women, was not adequately carried out, and thus it is not difficult to trace the results in the steady increase of the disease to the maximum during the decade in question. The slight decrease in 1896 is probably insignificant, but in 1897-98 three factors were in operation, one temporary, viz., the Tirah campaign, which withdrew large numbers of the men from cantonments; the others, which have existed ever since and have operated with ever increasing effect, were the new cantonment rules formulated as the result of the deliberations of Lord Onslow's Committee, and the system of treating many of the infected men as out-patients. Of the two last measures, the former aims at the expulsion of the diseased women from the neighbourhood of cantonments if they refuse treatment, and this has apparently met with varying and uncertain success; the latter has undoubtedly had two results at least; it keeps an uncertain number of cases out of the returns which formerly would have appeared therein, and it ensures better and more thorough treatment. It should, however, be noted that the cases so treated are largely convalescents previously reported, and also recurrent cases which under the old system would count as re-admissions, and so swell the returns beyond the actual number of fresh infections. So far, then, this new system has effected a decrease in the amount of disease reported, and beyond this, a real decrease by virtue of the better treatment it ensures which also reacts

by diminishing the number of sources of infection. In addition to these main factors there have been other influences at work, some fortuitous, and many of great value, and of more promise, as they are based on a truer recognition of the problem involved. The Boer war involved a great decrease in the annual drafts of young men for two years (1899-1901), and the prevalence of plague in native communities has caused many towns and villages to be put out of bounds for the troops. But there can be no question that the influences tending to the moral and physical amelioration of the soldier's lot have been greatly developed in the last few years by the combined efforts of the medical and military authorities. And this points the way to progress in the future; we must look to education of the men who suffer largely through ignorance and lack of self-control which are the results of the environment from which they are mostly drawn, and the lectures which are now a feature of many regimental institutes are a sign that this is becoming appreciated; to the provision of other healthy interests for the men's leisure, games, athletics, evening amusements and club comforts with, perhaps, encouragement of trade occupations or craftsmanship. And with all, the application of measures with sympathy to enlist the confidence and efforts of the men themselves, both in regard to prevention and treatment. This last will also apply to the women, for whose treatment ample provision should be made, for indications are not wanting that very much depends upon this and upon the methods adopted in working the rules applicable to them. Difficulties will not all disappear forthwith, but sympathy and other resources are not exhausted, and it is clear that a too arbitrary and indiscriminate exercise of authority leads to evasion of the code rules, to clandestine prostitution and to concealment and dissemination of the disease in other places, by both men and women. Lastly, it may be said that the measures for the prevention of the results of the importation of the disease from one station to another may be susceptible of improvement; and this by more complete notification between cantonment authorities, by greater care of, and influence exercised over, the men upon the march and those newly arriving. There must be co-ordination of resources, together with a definite policy adopted to the circumstances of each locality, and concentration of effort on the true lines of attack; for this, it is all-important to recognise the facts that certain of the men are specially liable to get into trouble, and that the danger is greatest at special times, in certain places and under special conditions, on all of which aspects the records throw light.

During 1903 there were 1,569·49 constantly sick on account of venereal disease, or about 140 more than in the previous year. The average period of detention in hospital for each case was 32·92 days, and the total loss of service involved amounts to 572,864 days, or 50,607 days in excess of the loss for 1902. The non-efficiency thus reckoned amounts to seven and a half times as much as that incurred on account of enteric fever.

There were 10 deaths (·14 per 1,000 of strength) directly due to venereal disease against 15 (or ·25 per 1,000) in 1902, and the number invalided for this cause was 213 (3·02 per 1,000) as compared with 310 (5·12 per 1,000). The results in invaliding this year, the lowest since 1889, have probably a direct connexion with the improved and more continuous treatment to which the men are now subjected.

Heat-stroke.—The death-rate from heat-stroke was approximately the same as in 1902, viz., ·77 against ·76; a considerable decrease in the Punjab and Madras Commands being balanced by a rise in that of Bombay. The stations chiefly affected were Nowgong, Nasirabad, Delhi, Fort Lahore and Lucknow.

Suicide.—The average annual number of suicides reported in the decade 1891-1900 was 19, and in 1903 there were 21, of which 12 were by gunshot, 4 by cut-throat, 2 each by drowning and hanging and one by oxalic acid poisoning; the means adopted maintain generally their relative positions in the list.

Invaliding.—From the whole European army in India, 2,063 men were invalided in 1903 (29·29 per 1,000 of strength, against 2,255 in the previous year (37·25 per 1,000). The millesimal rates ranged from 34·45 in the Madras Command to 25·39 in the Punjab, and there was a reduction in every case as compared with the previous year's results, which was most marked in the Burma district, and in the Punjab and Bombay Commands; the significance of these results has already been referred to. Fifty per cent. of the total number invalided were under 25 years of age, an age-period in which 51 per cent. of the total strength was included; 88 per cent.

of all the invalids were under 30 years of age, a category which comprised 86 per cent. of the total strength. Then as regards the effect of service in India, it is found that 30 per cent. of all invalids in 1903 had less than two years' service, a term which included 43 per cent. of the strength, and 64 per cent. of all invalids had been less than five years in the country, a condition that applied to 76 per cent. of the strength. As compared with the previous year there was a greater loss on this account among the younger men and among those of shorter service in India; it is true that in both respects there was a considerable increase in the proportions these classes bore to the total strength, but the proportions invalided were still higher. Sickness and mortality fall proportionally more heavily on the shorter service periods as compared with the lower age-periods, but the reverse is the case as regards invaliding.

Officers.—The average strength of commissioned officers with European troops in India in 1903 was 2,190, and among these there were 1,781 cases for treatment, 92 were invalided, and 29 died during the year. While the admission-rates from enteric fever, intermittent and remittent fevers, pneumonia, diarrhœa and hepatic affections generally showed a decrease, there was a rise in those from influenza, cholera, tubercle of the lungs, other respiratory diseases, dysentery and venereal affections. There were eight deaths from enteric fever, the chief cause of mortality, giving a rate per 1,000 of 3·65, which is lower than that for the troops (4·19), and a considerable decrease on that of 1902, viz., 6·21. Dysentery was, however, more fatal this year, five deaths having occurred in place of two in 1902. As compared with the incidence on the troops, the following diseases were more prevalent in proportion to strength, viz., influenza, small-pox, enteric and remittent fevers, dysentery, diarrhœa, and inflammation of the liver, while the officers suffered less from cholera, intermittent fever, tubercle of the lungs and all other respiratory diseases, hepatic abscess and venereal diseases, their comparative immunity from the last-named determining the difference in the respective combined admission-rates Heat-stroke, circulatory and "other respiratory" diseases, and dysentery and diarrhœa were the only chief causes of mortality which were more fatal to officers than to men. Two cases of plague occurred, but neither proved fatal.

Women.—There was a very slight improvement in the health of the women during 1903 as compared with the previous year, but still some falling-off from the results of 1901. The chief causes of admissions to hospital were, as usual, debility, ague, the diseases peculiar to women and bowel-complaints, which together accounted for 65·50 per cent. of all sickness. There were in all 41 deaths (14·18 per 1,000), of which enteric fever accounted for 7, intermittent fever for 4, cholera and pneumonia for 3 each, and dysentery for 2, yielding rates which are higher than those of the troops, for the second and third named causes only. The Burma district and Madras Command had the highest sick-rates, while in the former along with the Bengal Command the mortality was greatest.

Children.—The health of the children showed an improvement as compared with the previous year, but was somewhat less satisfactory than in 1901. The chief causes of sickness during the year under review were, as is usual, intermittent fever (20 per cent. of total), respiratory diseases (12 per cent.), diarrhœa (9 per cent.), and measles (6 per cent.); diarrhœa and enteric fever were more prevalent than in 1902, but the latter was only a little more than one-fourth as prevalent in proportion to strength, as it was among the troops. Out of a total of 173 deaths, diarrhœa was accountable for 31, anæmia, debility and immaturity at birth for 17, respiratory diseases for 17, dysentery for 13, and intermittent fever for 12, altogether for 52 per cent. of the total mortality; and intermittent fever, dysentery, tubercular diseases and cholera were all more fatal than in 1902. Among the exanthemata to which children are liable and which came under treatment during the year, were measles (145 cases), chicken-pox (94), rubella (8), scarlet-fever (5), small-pox (3); there were also 30 cases of mumps, 29 of whooping-cough and 11 each of diphtheria and dengue. Sickness and mortality were alike greatest in the Madras and Bombay Commands.

Native Troops.

Sickness and mortality in 1903.—The health of the native troops during 1903 must be regarded as exceptionally good, for the admission and constantly-sick-rates were the lowest on record, and the same may be said of the death-rate if the fatalities among men absent on furlough and sick-leave be disregarded. The average strength present in India was 124,660, and the following statement affords a comparison with the previous year and its antecedent quinquennium. This favourable result is to be ascribed to diminished prevalence of all the chief causes of sickness and mortality, although, as compared with 1902, there was some increase in the admission-rates for influenza, cholera, enteric fever and tubercle of the lungs, and in the death-rates from cholera and enteric fever.

Year.	Average strength.	Ratio per 1,000 of Strength.		
		Admissions into hospital.	Constantly sick.	Deaths.
1897–1901	126,127	794	31	11·92
1902...	124,231	718	27	11·16
1903...	124,660	662	25	10·04

The chief causes of sickness in 1903 were, as usual, intermittent fever, dysentery, venereal diseases, other respiratory diseases and pneumonia, in order of their relative prevalence, the first-named accounting for 37 per cent., and dysentery for nearly 6 per cent., of the total admissions to hospital. The chief causes of death were pneumonia, remittent fever and tubercle of the lungs, from which 30·5 per cent., 8·8 per cent., and 6·8 per cent., of the total mortality were recorded, respectively. The total number of men invalided for discharge during the year was 1,395, against 1,430 in 1902, the chief causes of this source of loss being, as usual, debility, intermittent fever, venereal disease, and rheumatism.

The native troops sufferent less than the European troops from small-pox, enteric fever, simple continued fever, diarrhœa, hepatic affections, and venereal disease, but, on the other hand, they were more liable to all the other chief causes of sickness, as also from scurvy, and this is in accordance with the usual experience. As regards sickness the great contrast lies in the relative incidence of venereal disease and enteric fever, and as regards mortality, while enteric fever and hepatic affections hold the first places among the European death-rates, pneumonia, remittent fever and dysentery are the diseases most fatal to their native comrades.

The strength of the China Garrison during the year was 1,745; the admissions to hospital, for which ague, influenza and venereal diseases were the chief causes, gave a ratio per 1,000 of only 298, as compared with 400 in 1902. The death-rate also fell from 13·83 to 12·03 per 1,000, and more than half of this was due to tubercle of the lungs. The Somaliland Field Force (strength 3,174) suffered chiefly from scurvy; ague, and pneumonia, the two former together accounting for 40 per cent. of all admissions, and the first and last combined for 37 per cent. of all mortality; altogether, the cases admitted for treatment amounted to 1,129 per 1,000 of strength, and the deaths to 25·83 per 1,000, but 17 men were killed in action, and if these be excluded, the death-rate falls to 20·4 per 1,000. The Aden Column Field Force (strength 983) had altogether 893 admissions to hospital or 908 per 1,000, ague and dysentery causing 60 per cent. of the whole, and there were 11 deaths, or 11·19 per 1,000, of which 6 were due to pneumonia. Sikkim-Tibet Mission Force which left India in March, and of which the average strength, calculated on an annual basis, was 929, had altogether 841 cases of sickness and 11 deaths up to the end of the year, and the ratios per 1,000 per annum were, therefore, 905·3 and 11·84, respectively; ague and dysentery were accountable for nearly half the former, and remittent fever for nearly half of the mortality. These details, summary as they necessarily are in the present state of the information available, serve at least to show the very various

conditions of climate to which the men are liable to be exposed, and the results must be considered eminently satisfactory, in view of the sensitiveness of the sepoy to any marked change from the conditions of his native habitat.

Commands.—In conformity with the results of the three previous years, the Bombay Command, in 1903, had the highest rates in regard to both sickness and

Ratios of Commands.

	Ratio per 1,000 of the Average Strength.					
	Bengal Command.	Punjab Command.	Madras Command.	Burma District.	Bombay Command.	Army of India.*
I.—Average Annual Strength	29,338	40,582	18,679	6,502	25,471	124,660
II.—Constantly-sick-rate of the Year	22·4	26·1	21·2	25·4	28·8	25·3
III.—Admission-rate of the Year—						
Influenza	7·4	3·6	2·8	·5	1·3	3·6
Cholera	·6	1·3	1·2	·6	1·4	1·1
Small-pox	·7	·7	·5	·2	·6	·6
Enteric fever	1·4	·6	·2	·2	·2	·6
Intermittent fever	197·7	278·3	111·2	331·9	315·3	247·4
Remittent fever	7·6	12·5	2·4	5·8	7·5	8·6
Simple continued fever	2·6	1·3	12·6	4·8	1·1	3·5
Tubercle of the lungs	4·3	11·7	1·2	3·7	2·9	5·9
Pneumonia	9·0	20·2	10·0	3·7	17·7	14·4
Other respiratory diseases	16·7	23·7	19·4	25·8	26·4	22·2
Dysentery	36·7	39·4	25·1	35·7	30·9	36·6
Diarrhœa	9·4	6·0	1·6	4·5	9·9	7·2
Hepatic abscess	·1	·1	·1	·2	·2	·1
„ congestion and inflammation ...	·6	·9	1·8	1·1	·9	1·0
Scurvy	1·0	1·8	1·0	·5	6·8	2·4
Venereal diseases	22·4	17·1	32·9	25·4	33·4	24·5
All Causes	614·6	692·4	484·4	730·2	756·8	662·0
IV.—Death-rate of the Year—						
Cholera	·37	·99	·48	·77	·59	·64
Small-pox	—	—	·05	—	—	·02
Enteric fever	·55	·17	·11	·15	—	·22
Intermittent fever	·78	·52	·32	1·38	·67	·66
Remittent fever	·85	1·13	·37	·62	·90	·88
Simple continued fever	—	—	—	—	·04	·01
Circulatory diseases	·07	·20	·48	·46	·35	·27
Tubercle of the lungs	·82	·96	·21	·46	·47	·68
Pneumonia	1·57	4·41	1·93	·15	4·20	3·06
Other respiratory diseases	·24	·15	·05	·15	·39	·21
Dysentery	·31	·15	·27	·31	·39	·30
Diarrhœa	·03	·10	—	·15	·27	·10
Hepatic abscess	·03	—	—	—	·04	·02
Anæmia and debility	·03	·05	·11	15	·20	·10
All Causes	8·21	10·60	7·33	7·54	13·47	10·04

* Excluding troops in China and Somaliland, and including troops in Extra India not in the Indian Command, and also including Delhi Coronation Durbar Force, Sikkim-Thibet Mission, and Aden Column Field Force, which are not included in the commands.

mortality. There was less sickness in proportion to strength here on account of intermittent fever than in the Burma district and less from pneumonia than in the Punjab, the admission-rates from tubercle of the lungs and from simple continued and remittent fevers were also well below the average for the rest of India, but in most other respects there is an excess, and notably under venereal disease, diarrhœa and other respiratory diseases. Respiratory affections, bowel complaints and anæmia and debility are chiefly accountable for the higher mortality. The Punjab Command ranks next in order of unhealthiness, as was the case in the previous year, and this is due to the excessive sickness from remittent fever, tubercle of the lungs, pneumonia and dysentery, and to the higher mortality on account of the first three causes, and from cholera. The predominance of these affections is typical of the Punjab returns, as a rule, and explains the position of this Command at the head of the mortality list when a sufficiently long period, to obviate temporary fluctuations, is considered.

Geographical groups.—There were very great contrasts, as usual, in the incidence of sickness and mortality on the troops located in the different geographical groups. Taking the combined figures for the last quinquennium (1899-1903), the highest admission-rates were returned from Bengal-Orissa (IV), Burma Inland (II) and North-West Frontier and Indus Valley (VII), ranging from 1,035 to 881 per 1,000 of strength, the Gangetic Plain (V) and Upper Sub-Himalaya (VI) being at the other end of the scale with rates of 573 and 618 per 1,000, respectively, and this is notable inasmuch as the two latter areas constitute the natural habitat of the majority of the sepoys in the service. The contrast is chiefly due to variations in the incidence of intermittent fever. In regard to mortality, during the same period, the first place is taken by Western Coast (X) with 14·72 per 1,000, closely followed by the Hill Stations (XII) with 14·53, and then by the North-West Frontier (VII) with 13·82, while Assam (III) and Burma Inland (II) are at the other end of the scale, with rates of 7·47 and 7·45 per 1,000, respectively. Here the contrast is chiefly ascribable to the greater prevalence and fatality of pneumonia and other respiratory diseases and of remittent fever in the former areas, to which may be added an excessive mortality from bowel-complaints in group X. In this last the average strength is low,* but as regards the other two groups (XII and VII) climatic causes, and notably a high range of temperature with sudden falls and a very low thermometer at night for several months in the year, are sufficient to account for the results when the native disregard for ventilation is borne in view. It may be added that in 1903 there was no marked change in the order based on past experience. It is important to grasp the fact that the men serving in these two areas are for the most part strangers in a foreign land, the climatic and other conditions of which are very different from those of their homes. The Hill Stations (XII) are dotted along the fringe of the empire, at various but always considerable altitudes, from Burma at one end, through Assam and along the lower Himalayan range in the north, and thence along the North-West Frontier to Quetta in the west. The position of the other group (VII) is indicated in its name,—North-West Frontier, Indus Valley and North-West Rajputana, and nothing need be added to what has been said in regard to it. But it is advisable to distinguish as regards the Hill Stations (XII), between those on the northern frontier (Himalayan) and those on the north-western and western frontier from Chitral to Quetta, because the contrast with the natural climatic conditions of the plains of India proper is greater in the latter than in the former sub-group. Taking the mean results for the last triennium (1901-3), a period free from war operations, it will be found that while the combined admission-rate per 1,000 of strength (all causes) was 636, and the death-rate 8·8 in the first series of Hill stations, it was 988, and 17·4 per 1,000 respectively for the second series, *i.e.*, 50 per cent. more sickness and about 100 per cent. more mortality. Thus the North-West and Western Frontier and the Indus Valley stations stand out as the most unfavourable to the health of the native army, and the facts are of sufficient importance as to warrant a more detailed statement of the contrast.

---

* There are only three stations in Group X, viz., Bombay, Cannanore and Trevandrum; the average annual strength during the period in question was just over 2,000, of which two-thirds were located in Bombay, and the majority of the men here were recruited in the Dekhan, Rajputana, and the Punjab.

Ratios of Geographical Groups.

—	Ratio per 1,000 of the Average Strength.												
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	
	Burma Coast and Bay Islands.	Burma Inland.	Assam.	Bengal and Orissa.	Gangetic Plain and Chutia Nagpur.	Upper Sub-Himalaya.	North-West Frontier, Indus Valley, and North-Western Rajputana.	South-East Rajputana, Central India, and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	Army of India.*
I.—Average Annual Strength	1,254	4,133	1,340	2,474	6,857	15,987	17,283	12,202	16,596	2,047	7,170	21,676	124,660
II.—Constantly-sick-rate of the Year.	23·7	26·5	33·0	25·7	21·0	20·5	28·4	29·0	21·4	32·7	27·6	33·8	25·3
III.—Admission-rate of the Year—													
Influenza	1·6	—	1·5	—	1·3	2·1	·2	1·5	4·4	—	—	14·1	3·6
Cholera	—	1·0	—	—	1·9	2·4	·5	—	—	—	·3	·7	1·1
Small-pox	·8	—	—	·8	1·8	·9	·8	·7	·2	5·4	·1	·4	·6
Enteric fever	—	·2	5·2	—	·3	1·1	·4	·5	·1	—	·1	1·5	·6
Intermittent fever	354·9	383·3	301·5	337·9	112·4	219·6	328·9	378·1	174·3	209·6	113·9	272·1	247·4
Remittent fever	4·0	7·7	18·7	6·9	3·6	12·3	12·3	7·2	3·9	2·0	2·0	10·1	8·6
Simple continued fever ..	5·6	5·3	·7	·4	—	2·6	1·0	5·5	1·8	—	30·5	·4	3·5
Tubercle of the lungs ..	1·6	3·6	3·0	1·2	3·1	7·9	5·1	4·7	1·4	1·0	1·7	16·1	5·9
Pneumonia	2·4	2·9	8·2	6·5	6·3	15·1	22·6	19·8	6·6	8·3	12·8	20·7	14·4
Other respiratory diseases	25·5	26·9	26·9	23·0	11·8	20·1	30·1	22·1	15·0	31·3	25·1	28·2	22·2
Dysentery	63·8	32·4	85·1	59·4	36·8	25·3	42·7	23·5	26·9	41·0	29·4	41·8	36·6
Diarrhœa	·8	6·3	10·4	19·4	6·6	6·3	5·0	5·7	2·2	10·3	2·2	11·5	7·2
Hepatic abscess	—	·2	—	—	·1	·1	·1	·2	·1	·5	·1	·1	·1
„ congestion and inflammation.	2·4	·7	—	1·2	·4	·4	·6	1·0	1·2	2·0	2·4	1·2	1·0
Scurvy	·8	·5	5·2	·4	1·3	1·4	2·5	2·2	1·3	2·4	2·0	5·5	2·4
Venereal diseases	47·0	22·0	31·3	36·0	16·8	17·1	17·8	33·3	34·1	46·4	40·0	25·1	24·5
All Causes ..	806·2	770·6	826·9	759·1	490·4	575·3	788·2	829·2	575·8	701·0	591·2	759·6	662·0
IV.—Death-rate of the Year—													
Cholera	—	1·21	—	—	1·17	1·94	·23	—	—	—	·14	·37	·64
Small-pox	—	—	—	—	—	—	—	—	—	·49	—	—	·02
Enteric fever	—	·24	1·49	—	·15	·31	·06	·16	·12	—	—	·55	·22
Intermittent fever	1·59	1·69	1·49	·81	·58	·88	·52	·57	·36	·98	·14	·74	·66
Remittent fever	—	·97	·75	·81	·73	1·81	1·16	·90	·54	·49	·70	·74	·88
Simple continued fever ..	—	—	—	—	—	—	—	·08	—	—	—	—	·01
Circulatory diseases ..	·80	·24	—	—	—	·38	·06	·16	·42	1·95	·14	·28	·27
Tubercle of the lungs ..	—	·48	·75	—	·15	1·31	·69	·41	·12	·49	·28	1·61	·68
Pneumonia	—	·24	1·49	1·62	1·17	3·57	5·27	3·85	1·69	·98	1·95	4·71	3·06
Other respiratory diseases	·80	—	—	—	·29	·25	·23	·49	·12	·49	—	·18	·21
Dysentery	—	·48	1·49	—	·44	·19	·12	—	·18	·98	·28	·42	·30
Diarrhœa	—	·24	—	—	·15	·13	·17	·08	—	·49	—	·02	·10
Hepatic abscess	—	—	—	—	·15	—	—	—	—	—	—	—	·02
Anæmia and debility ..	—	—	—	—	—	—	·12	·08	·12	—	·14	·23	·10
All Causes ..	7·18	7·98	9·70	4·85	8·02	12·76	10·13	10·74	7·83	12·70	7·53	13·06	10·04

* *See* footnote to Table on p. 61.

Sickness and mortality of the troops in the Hill stations (Group XII); contrast of Northern stations with North-Western and Western Frontier stations—mean ratios for 1901–3.

—		Intermittent Fever.	Remittent Fever.	Tubercle of Lungs.	Pneumonia.	Other Respiratory diseases.	Dysentery and Diarrhœa.	Scurvy.	Anæmia and Debility.	All Causes.
Northern stations	A.	178·5	16·1	18·7	11·9	17·9	32·8	1·0	12·2	636
Maymyo to Kalabagh	D.	·72	·97	2·70	1·25	·28	·16	—	·16	8·8
N.-W. and W. Frontier	A.	436·9	23·8	6·2	24·8	42·8	80·9	8·3	23·2	988
Gilgit to Chaman	D.	·80	2·02	1·60	7·16	·53	·75	·4	·4	17·4

It will be seen how much heavier the incidence is on the latter group in regard to all the causes tabulated, save only tubercle of the lungs, and this departure from the contrast is due to the special liability to this disease of the Gurkhas who are, for the most part, located in stations in the former group (see page 69). The contrast here demonstrated is enhanced when the "absent deaths" and invalidings are taken into account. In the former, northern series of stations, the "absent deaths" in 1903 amounted to 1·67 and the invalidings to 10·59 per 1,000 of strength, whereas in the latter, western frontier series, these ratios rise to 4·66 and 12·17 per 1,000, respectively.

Stations and regiments.—There were only two stations which had an average strength of over 1,000 men in 1903, and in both the sickness and mortality was exceptionally heavy. At Mian Mir the death-rate was 29·17 per 1,000, of which just over one-half was due to cholera, and another fourth to pneumonia; and at Ferozepur the death-rate was 22·97 per 1,000, of which one-third was due to pneumonia and one-fifth to remittent fever. As regards stations occupied by smaller numbers of troops, if a list be made of the fifteen having the highest death-rates during the last five years, it will be found that on the average, eight of the stations which are situated on the North-West or Western Frontier appear in the list every year, pneumonia and remittent fever being chiefly accountable for the excess mortality. Among the regiments with the most unhealthy record during the year, and to which reference will be made in the subsequent remarks, were the 104th Rifles at Fort Sandeman, who suffered chiefly from ague, pneumonia and scurvy; the 32nd Lancers at Loralai, from ague; the 4th Rajputs at Wana, ague and pneumonia; and the 11th Lancers at Mian Mir, from cholera and ague.

Influenza.—The admission-rate on account of influenza rose from 2·1 in 1902 to 3·6 in 1903, while, as will be seen, the sickness from respiratory diseases, excluding tubercle of the lungs, was less prevalent in the army as a whole. The month of maximum prevalence during the past three years has been February, or somewhat in advance of the local epidemics affecting the European troops. The largest numbers of admissions were recorded among the men at Lansdowne, Dharmsala, Aurangabad, Dehra Dun, Kirkee and Jhansi, the Bengal and Punjab Commands being chiefly affected.

Cholera.—There were 135 cases of cholera in 1903, with 80 deaths, the incidence of attacks on strength being the same as among the European troops and the prisoners. The figures are an increase on the 26 cases and 15 deaths of the previous year, but the rates are only a little more than half the decennial ratios (1891-1900). The most considerable outbreak occurred at Mian Mir, whence 34 cases with 29 deaths were returned from three regiments, the 11th Lancers having 22 and 17 of these, respectively. The disease broke out in June and lasted a little more than a month, but the great majority of fatalities occurred within one week of the outbreak, the type of attack being very severe. No remarks are offered by the medical officers concerned on the etiology of the epidemic, but from the sanitary report on the cantonment it would appear that infection was attributed to the use for drinking purposes of canal water

which is liable to pollution by native civilians, no protected pipe supply being yet available as in the case of the European garrison. Twenty-one cases with 8 fatalities occurred among the 77th Moplah Rifles at Salem in January, the outbreak commencing while the regiment was on the march, and it was attributed to the consumption of infected water or food in the native bazaar. In a detachment of the 128th Pioneers which was posted as a cordon round a cholera-infected village, there were 18 cases with 7 deaths in June, and in the same month also and in the same area (Baluchistan frontier) the 113th Infantry had 12 cases and 7 deaths for which details are lacking; the disease was, however, epidemic in the villages in the neighbourhood.

Small-pox.—There were 78 admissions and 2 deaths from small-pox during the year, the rates per 1,000 of strength being precisely the same as for 1902; while the rate of attack is slightly above that for the decennium (1891-1900), the mortality rate is decidedly less. The disease was less prevalent than among the European troops, which is contrary to previous experience, and it was far less fatal, which is according to the general rule. The largest number of admissions, 8, was reported from Cannanore, all among the 87th Punjabis; there were 7 at Lucknow and 6 at Umballa. The records are incomplete as regards the discussion of the sources of infection and the previous vaccination of the men attacked, but so far as information is available, these all bore satisfactory marks of the prophylactic or, rarely, of a previous attack of the disease.

Ague, remittent fever, simple continued fever.—Intermittent fever accounted for over 37 per cent. of the total number of admissions for all causes in 1903, but the admission-rate which was 358 per 1,000 in 1901, and 274 in 1902, fell still farther to 242, which is just over 100 per 1,000 less than the mean for the decade, 1891-1900. From all but two of the twelve geographical groups the admission-rates were lower than in 1902, the two exceptions being Burma Coast (I) and Assam (III), Burma Inland (II) and Central India (VIII) being at the head of the list as was the case in the previous year; and the last remark applies to the Bombay and Punjab Commands and the Burma district. October was, as usual, the month of greatest prevalence of the disease when the records from the army as a whole are combined, and fewest cases occurred in March. Of the stations at which the average strength was over 100, those where the admission-rates were highest (exceeding 1,000 per 1,000) were Keng Tung (Burma), Deesa, Ahmedabad, Chakdara and Wana, the three first appearing in the same list in 1902. The plain of Keng Tung, 90 square miles in extent, with the highlands surrounding it on all sides, forms a huge natural basin of impermeable clay soil which is covered throughout its vast extent by rice swamps. The cantonment stands on the spurs of the low hills jutting into this plain, and its boundary includes the junction of hill and plain where many depressions and natural, but irregular, drainage channels abound. The annual rainfall is 75 inches, the ground water level is high and the whole plain is intersected by numerous water-courses. The barracks are of the bamboo hut type, and not much more than 500 yards from a "not over-clean" Shan village, while an Indian bazaar connects the two communities; the habits of the Gurkha sepoy are extremely sociable. Under these circumstances it is scarcely surprising that, in spite of the use of mosquito nets, 90 per cent. of the men have been under treatment for malarial fever, at one time or another. The physical difficulties prevailing at Deesa—the proximity of the Banas River, a small stream often reduced to stagnant pools in a wide sandy bed in which cultivation is carried on—were alluded to in last year's report. The accounts given of other notoriously malarious cantonments vary in detail; for example, at Dera Ismail Khan it is said that after heavy rain the city is flooded and the cantonment and its vicinity is under water; the drains that intersect the lines are mere earthen channels, with no proper and adequate fall, the difficulties being enhanced by the low-lying site. The situation at Delhi is very similar to that just described at Deesa. All this goes to show the physical difficulties that present themselves to any attempt to deal radically with the problem of the prevention of the breeding of mosquitoes in many of the stations, to which end efforts have been directed generally with more or less energy on the approved lines. The proximity of native civil communities and the intercourse of the sepoys therewith, must also be a frequent and an insuperable difficulty. And thus, along with the general sanitary measures that often fail to influence the prevalence of the *anopheles*, resort to the administration of quinine as a

prophylactic is generally practised though, in this matter, as in the case of the European troops, the methods and the system vary and the results, consequently, are, so far, too often inappreciable. Where nothing can be done to ameliorate the physical conditions, short of removing cantonments from their present sites, or of abolishing irrigation on which the food supply of the people depends, or of deflecting the courses of rivers, or of altering the whole configuration of the country, the efforts towards personal prophylaxis in cantonments and in hospitals must be systematized and carried out with energy and completeness, till the measures become ordered habits of the men's lives.

Remittent fever, to which more sickness and mortality is attributed among the native troops than among their European comrades or the prisoners was much less prevalent during the year; the mean admission-rate for the decade (1891-1900) was 15·2 per 1,000, and the death-rate 1·25, whereas the rates fell in 1903 to 8·6 and ·88 per 1,000, respectively; nevertheless, nearly 9 per cent. of the total mortality was attributed to this cause. Cases are generally most numerous in the dry hot spring and winter, and in 1903 the maximum prevalence was in January, though cases were admitted throughout the year. The remarks of medical officers on the subject of the etiology of this form of fever are not very illuminating, and where the microscope is not systematically employed little could be expected. It would appear that change to a more rigorous climate and to unaccustomed surroundings are important factors in inducing attacks, and the regiments that suffered most were, in many instances, exposed to these conditions, *e.g.*, on the North-West Frontier, in the Indus Valley and on the Sikkim-Tibet expedition. The incidence was by far the heaviest on the Punjab Command, and on groups III, VI, VII, and XII, and this is in accordance with previous experience. It may be added, in connexion with the marked progressive decline in the admission-rates alluded to above, that where these have been consistently lowest, as in the Madras Command, the decrease is inappreciable during the past ten years, and it may be that more exact diagnosis, or that a question of nomenclature has had some influence on the returns from elsewhere. For it is remarkable that with this low remittent fever rate, the Madras Command has always returned the highest number of cases of simple continued fever in proportion to strength, just as the Punjab with the highest rate from remittent has always been at the bottom of the list for the simple continued variety.

As regards this simple continued fever the decline in the reported incidence has everywhere been still more marked than in the case of remittent, the mean admission-rate for the whole army having been 9·1 per 1,000 during 1891-1900, while in 1902 it was 5·1, and in 1903 it fell to 3·5. Against the last figure may be set the rate for the Madras Command, 12·6, and that of groups XI (Southern India), 30·5, to show how large a proportion of the disease is accounted for in a comparatively small area. Indeed, out of a total number of 441 admissions throughout India during the year, no less than 153 were recorded in one regiment, at Bellary, the 74th Punjabis, consisting of men who were recruited in Northern India at the end of 1902. Here we may, perhaps, see the effects of a complete change of climate inducing ephemeral fever, during the period of physiological adjustment, or possibly malarial relapses.

Enteric fever.—The admission-rate on account of enteric fever has shown a tendency to a small but regular and definite increase during the last few years. During the first three lustra with which the records deal, *i.e.*, up to 1891, the rate

Enteric Fever—Native Troops.	Ratios per 1000.	
	A.	D.
1877–1891	·21	·09
1892–1896	·25	·06
1897–1901	·3	·11
1902	·4	·10
1903	·6	·22

per 1,000 did not vary materially from ·21, and the death-rate was approximately ·1, a case mortality of nearly 50 per cent. The subsequent course of the incidence of the disease is shown in the above summary; it will be seen that the rates have exactly doubled within the last six years. It is difficult to decide how much of this reported increase connotes a real extension of prevalence, and how much is due to altered diagnosis, and it is not impossible that a certain amount of what was formerly returned as remittent fever has found a place under this head; for with the diminution of remittent fever, already noticed, there has also been a reduction of the case mortality from both diseases, which might be accounted for on the suggestion hazarded. An important point which the returns bring out clearly is the much greater incidence of enteric fever on the Gurkha sepoys,* and, further, its comparative localization in the cantonments occupied by them. For instance, during the last four years, 107 cases have been recorded among the Gurkhas, with an average annual strength of 11,458, yielding a mean rate per 1,000 of 2·3, whereas from the rest of the native army, annual average strength 112,332, only 103 admissions were reported, or ·22 per 1,000, which is just under one-tenth of the Gurkha rate. Again, to turn to the year under review, of the total of 80 cases reported, 37 were distributed among the Hindustanis (·32 per 1,000) while 43 remain for the Gurkhas (3·4 per 1,000) and these 43 were reported from 7 stations, whereas the other 37 were the contributions of 24 stations, of which 21 recorded only one case each. These facts explain the relatively heavy incidence of the disease on geographical groups III and XII (Assam and the Hill stations), and beyond this, it may be said that in the greater part of the native army (Hindustanis), the disease, if present, is not recognised, or, at most, in negligible quantity. The possibility that the disease is truly more prevalent but is concealed in the returns under one or other of the common fevers is, as was shown in this report for last year, rendered less plausible from the fact that the combined death-rate from these fevers, including enteric, is very much lower among the natives than it is among the European troops; and this could only be the case on one of two

——	European troops. Deaths per 1,000, 1903.	Native troops. Deaths per 1,000, 1903.	Prisoners. Deaths per 1,000, 1903.
Enteric fever	4·19	·22	·25
Intermittent fever	·34	·66	·94
Remittent fever	·4	·88	·36
Simple continued fever	·01	·01	·01
Total fever mortality	4·68	1·77	1·56

hypotheses. Either enteric fever is not overlooked to any material extent, or the disease runs a much milder, a very anomalous, and less fatal course among the natives. It is quite true that so-called remittent fever is much more fatal to native troops and prisoners than to Europeans; it is true, further, that the remittent fever rates have recently fallen coincidently with a rise in the enteric rates among the two former classes. But if the whole of the mortality from remittent were transferred to the account of enteric, it would still leave a great balance of comparative immunity from the latter disease, in favour of the native adult. It is to be noted that the remittent fever rates are consistently lower among the prisoners than among the native troops, but there is no corresponding excess in the enteric rates among the former. Methods of diagnosis may undoubtedly affect the contrast in the remittent rates in the different classes; there are fewer cases in proportion to strength diagnosed as remittent fever among the prisoners, but there is a higher case mortality of those so diagnosed than among the native troops, but the enteric rates are practically identical in the two classes; and as regards fatal cases of both diseases among the prisoners, the great

* The increase in the rate already noticed is common to both Hindustanis and Gurkhas, but is much more marked among the latter.

majority are submitted to an autopsy, which should preclude any large source of error. Lastly, the age factor can scarcely be invoked to explain the whole difference in this respect between the native and European troops; the age constitution of the former is, unfortunately, not available, but it would doubtless be found that there is a smaller proportion of the strength at the most susceptible ages among them and by so much the incidence would be reduced, if we may presume that the ages of susceptibility are the same in both.

It must be admitted that the evidence which is relied on in the diagnosis of enteric fever among natives is, for the most part, clinical, in which a process of exclusion of other causes plays a large part, and, in the case of prisoners, this is supplemented by the signs of gross pathological changes found post-mortem. Beyond this, there is the accumulating evidence based on the results of the Widal reaction, which was fully summarised in this report for 1901. It is obvious that a diagnosis which in the present stage of the question, is made on clinical grounds or from the gross pathological signs is frequently open to grave doubt, if only from the risk of overlooking cases that present no typical intestinal lesions. It is, therefore, eminently desirable, nay necessary, that medical officers should avail themselves in all cases of doubt of the facilities now at their disposal for the application of the more exact and reliable tests of the blood and excreta during life and of the organs after death. It is only by the employment of these methods that an escape will be found from the cloud of conjecture in regard to enteric fever itself, and that we may hope to elucidate the causes of other anomalous fevers.

As to the causes of the special liability of the Gurkha sepoy to the disease, nothing can be added to the discussion of the subject in previous issues of this report. In regard to etiology, the medical officer of the 2nd battalion, 3rd Gurkha Rifles, among whom 13 cases occurred, attributes the infection to polluted spring water in which the *bacillus coli* and the *bacillus enteritidis sporogenes* were demonstrated. At Manipur, polluted river water was suspected, the separate supply for drinking being accounted beyond suspicion as it was boiled before issue. In other cases bazaar milk and fæcally contaminated dust were suspected, and it is noted that the sepoy is addicted to the dangerous practice of cleaning his eating and cooking vessels with surface soil from the handiest spot.

Malta fever.—Eight cases of Malta fever were recorded during the year, against four in 1902, but of only three are details given as to the symptoms and the grounds on which the diagnosis was based. The two cases among the 15th Sikhs at Fort Lockhart were originally admitted for intermittent and remittent fever, but on subjecting the blood to the sedimentation test complete reactions were obtained with dilutions of 1 to 50 and 1 to 200, respectively; the source of the micrococcus used is not stated.

Plague.—The incidence of plague on the native troops cantoned throughout India has been as follows: in 1898, 94 cases with 54 deaths; 1899, 76 and 45; 1900, 56 and 29; 1901, 70 and 41; 1902, 192 and 95; 1903, 184 and 115. The great extension of the disease among the civil population, during the year under review, has therefore not been accompanied by a corresponding increase among the native troops. Out of the total of 184 stations occupied, 57 were situated in or near towns or in districts in which plague occurred among the general population, but of this 57 only 24 had cases among the sepoys. The largest number of attacks reported from one station was 26 at Bangalore, and these were distributed among four different corps. Very few details are given of this outbreak by the medical officers concerned, but the disease prevailed in epidemic form in the civil and military lines and there was doubtless constant communication with the infected area either direct or indirect by means of followers, tradesmen, &c. Mention is made of the prophylactic inoculation of 681 volunteers in the 28th Light Cavalry in which one case only occurred, and of two cases of plague in the Moplah Rifles, one who had been inoculated, recovered. The only other considerable outbreaks occurred in two regiments at Aurangabad (21 cases, 7 deaths); at Poona (18 and 10); Mhow (16 and 14); Sehore (14 and 9); and Neemuch (10 and 3); on the other hand, in 5 stations there was only a single case in each, and in 4 others, 2 cases in each. The reports call for no comment; sources of infection were, in all cases, abundant in and around cantonments; the measures adopted consisted, generally, in putting infected places out of bounds for the troops, the segregation and observation of men arriving, or returning,

from infected places; and on the outbreak of the disease, prophylactic inoculation for all willing to accept it, including followers and families, segregation of the sick, evacuation of the lines by the healthy and temporary sojourn under canvas, and all measures of disinfection of infected quarters and of the lines and barracks. It may be said that the consensus is decidedly in favour of the beneficial effects of inoculation in reducing the liability to attack and also the case mortality, but the details given in each case are rarely complete and scarcely permit of a summary which would have scientific value.

Cerebro-spinal fever.—As in the case of the prisoners, cerebro-spinal fever has notably decreased during the last year, there having been only 6 cases with 4 fatalities recorded from the whole native army, against 18 and 17, in 1902, and 28 and 21, respectively, in 1901. The disease has been most prevalent in the Punjab Command and on the frontier, but not confined thereto, and this year the six cases were reported, one each, from Kohat, Edwardesabad, Delhi, Jhelum, Roorkee and Mhow. No reference is made to the etiology or diagnosis of these cases in any of the returns.

Tubercle of the lungs.—It is interesting to compare the incidence of tubercle of the lungs on the European troops, the native troops and prisoners, respectively, during the last year and the previous quinquennium. While on the mean for the longer period the rates for the native troops, and especially the death-rate, are higher than those of the Europeans, they compare very favourably with those of the prisoners. But there has been a very notable rise in the amount of the disease reported among the native troops, though the mortality remains fairly stationary; for instance, the mean admission-ratio for the decade ending 1900 was only 2·8, and the death-rate ·69, and the former has since then gradually risen to just over twice

Tubercle of Lungs—India.	Ratios per 1,000 of Strength.			
	1898–1902.		1903.	
	A.	D.	A.	D.
European army	3·2	·55	3·4	·24
Native army	3·8	·76	5·9	·68
Prisoners	8·7	3·78	9·3	3·85

the amount. It is probable also that many deaths occurred among men who were absent from their regiments, and these cases are not accounted for in the death-rate. Turning next to the distribution of the disease in place and on personnel and taking the returns for 1903, it will be seen first, that the case-rate in the Punjab Command is just twice as high as that for India as a whole (11·7 against 5·9 per 1,000), the quinquennial rates, however, give the Bengal Command an incidence equal to that of the Punjab; next, as regards the geographical groups in the year under review, the Hill stations (XII) stand out with a rate of 16·1 per 1,000, followed by Upper Sub-Himalaya (VI) with 7·9, all the rest being below the average. This unfortunate pre-eminence of group XII is chiefly due to the excessive incidence on the Gurkha sepoys, which is clearly shown by the following facts. There were altogether 730 cases with 85 deaths (excluding "absent" deaths) recorded in the whole native army in India during the year; but no less than 362 and 36, respectively, were reported from the Gurkha regiments, or about one-half of the total on little more than one-tenth of the aggregate strength. Putting this in terms of ratios per 1,000 of strength, it will be found that while for the native army as a whole, excluding the Gurkhas, the pulmonary tubercle rates were 3·2 and ·43, they were actually 28·9 and 2·8 per 1,000, respectively, for the latter class alone, the case incidence being 9 times and the mortality nearly 7 times greater.

There were only six cases returned as non-tubercular phthisis during the year, as compared with 23, with one death in 1902.

Pneumonia and other respiratory diseases.—Pneumonia is invariably the chief cause of death among the native troops, and in 1903 it accounted for over 30 per

cent. of the total mortality; a comparison with the incidence on the European troops and prisoners is given in the statement below, which extends back to 1891, and it shows what an important part the disease plays in the vital statistics of the two native classes. As regards the native army there has been little variation in the rates during the last 13 years, but the slight diminution reported in 1903, as compared with the previous year, is so far satisfactory in view of the increased prevalence of influenza already noted. A glance at the Table on page 63 will show how disproportionately heavy the incidence of pneumonia is on groups VII (North-West Frontier and Indus Valley) and XII (Hill stations), and these are followed at no great distance by VIII and VI, while Burma (I) stands at the other end of the scale, and this is according to the usual experience. This distribution will also explain the prominent position taken by the Punjab and Bombay Commands in the returns, and when it is added that the months of greatest prevalence were December, January and February, the effect of the low temperatures in the continental and more elevated areas will be evident. Natives of India, who are so universally subject to malarial infection, when aggregated in an unaccustomed climate are peculiarly liable to affections of the lungs, to which also their domestic habits greatly contribute; for their first impulse is to exclude the cold air by preventing ventilation and by covering their heads at night with blankets and quilts which are generally polluted with pulmonary excretion. The highest admission-rates are almost invariably returned from the hill stations on the North-West and West Frontier, and during the past year rates of over 50 per 1,000 of strength were recorded in Wana, Mirali-Khel and Fort Sandeman, and if the statistics for the triennium (1901-02) be analysed, it will be found that in the line of Stations from Gilgit to Chaman the troops had mean admission and death-rates of 24·8 and 7·15 per 1,000, respectively. Only little less susceptible are the men stationed just within the line of frontier outposts, and then the more or less aboriginal tribesmen who serve in the hilly tracts of Rajputana.

Pneumonia.	Ratios per 1,000 of Strength.					
	1891–1900.		1902.		1903.	
	A.	D.	A.	D.	A.	D.
European troops	3·8	·60	5·9	·97	4·6	·57
Native troops	14·4	3·24	15·3	3·7	14·4	3·06
Prisoners	16·2	4·27	13·2	3·38	13·6	3·62

The foregoing considerations apply very generally to the incidence and distribution of other respiratory diseases among the native troops, having regard to the fact that the list includes several different pathological conditions with no etiological identity. A retrospect shows that there has been a very considerable diminution in the sick and mortality rates under this heading since 1895, a feature which the statistics of the prisoners also exhibit. The state of the case as regards the native army may be appreciated when it is stated that the millesimal admission and death-rates for the decade (1891-1900) were 33·2 and ·61, whereas in 1903 they had fallen to 22·2 and ·21, respectively, which, indeed, are the lowest on record. The records invite no comment beyond the statement that the incidence in proportion to strength was greatest on the small Western Coast group (X), on the North-West Frontier and Indus Valley (VII) and the Hill stations (XII), while, in regard to individual stations, some of those on the North-West and Western Frontier stood at the head of the list in the past year.

Dysentery (I.) and Diarrhœa.—There has been a notable decrease in the sickness and mortality from dysentery during the last five years, a feature of the returns which has already been noticed as regards the European troops, and which those of the prisoners also exhibit in less degree. It will be seen that, in the case of the native troops, the admission-rate for the year has fallen by 25 per cent., and the death-rate by about 50 per cent., from the respective decennial means, and, indeed,

these are the lowest figures on record. As a general rule the highest admission-rates are reported from the Assam and Bengal-Orissa groups (III and IV) followed by the Burma groups, the North-West Frontier and Hill stations being also above the mean for India, and with slight modifications this order holds good for the year under review; this may furnish another instance of the fact that sickness is least prevalent where the sepoy is most "at home." Of the ten stations with a strength of over 100 men, where the admission-rates exceeded 100 per 1,000, four are situated in the hills and three in the Indus Valley, and the combined mean rate for the line of Frontier posts along the North-West and Western Frontier amounted to 65 per 1,000 during the last triennium.

Dysentery.	Ratios per 1,000 of Strength.					
	1891–1900.		1902.		1903.	
	A.	D.	A.	D.	A.	D.
European troops	29·6	·87	20·4	·69	16·9	·70
Native troops	48·8	·59	46 0	·39	36·6	·30
Prisoners	99·6	6·81	96·4	5·13	88·8	3·73

A very marked decline in the morbidity and mortality from diarrhœa has been a feature of the returns during the last six years, both as regards the native troops and the prisoners. For the former, the mean admission and death-rates for the decade (1891-1900) were 13·6 and ·26 per 1,000, but in 1903 the figures were 7·2 and ·10 per 1,000, respectively, the sick rate being the lowest on record. The relative distribution of the disease, under this name, which merely refers to a symptom, is very similar to that of dysentery, and it is in accordance with common experience that in 1903 the returns were highest from the Bengal-Orissa (IV) and the Hill stations (XII) groups. Medical officers of the cantonments where the disorder was most prevalent ascribe the attacks chiefly to chills and to indiscretions in diet.

Venereal diseases.—Venereal diseases were ten times more prevalent among the European troops during 1903 than among their comrades of the native army, there being only 24·5 admissions for this cause for every 1,000 men among the latter against 247 per 1,000 in the case of the former; the decennial mean rates (1891-1900) were 37 and 431 per 1,000 for the two armies, respectively. The "civil condition" of the two classes and the other conditions under which they serve are very different, and in the case of the natives we have no parallel to the extraordinary fluctuations in the rates which characterize the European returns. During the last quarter of a century the sick-rate from this cause for the native army has never risen above 42 per 1,000, and it has never fallen so low as that of the year under review, 24·5.

A few words may be devoted to the distribution of venereal disease in the native army; and first, it may be said that the Gurkhas invariably suffer in a much higher degree than the rest of the troops, while the sepoys in the Punjab Command show to great advantage in this respect, those in Bengal coming next, but at a very considerable interval. This comparative immunity is doubtless due to the fact that the men are serving close to their homes in these Commands. While the admission-rate for Gurkhas in 1903 was 38·7 per 1,000, it was only 13·6 for the troops (excluding Gurkhas) in the Punjab Command, and for the whole of the rest of the native army it was 27·1; so that, if the Gurkhas be excluded, the amount of sickness in proportion to strength is only half as great in the Punjab Command as in the rest of India, and statistics for a longer period confirm these relative positions in all essential respects.

Beri-beri.—There were 122 cases of beri-beri admitted during 1903, of which 8 were fatal, against 84 and 10, respectively, in the previous year; the disease was, as usual, practically confined to the regiments serving in the Madras Command. On the whole, there has been comparatively little variation in the incidence of the

disease reported,* either in amount or distribution for many years past, the average annual number of cases since 1894 being 120, and those occurring outside Madras or Burma being rare exceptions. This year no less than 113 cases out of the total of 122 were reported from three regiments, viz., the 63rd Palamcottah Light Infantry, which was stationed at Singapore and Vizianagram, 50 cases; the 73rd Carnatic Infantry, at Singapore, 47 cases; and the 81st Pioneers, at Secunderabad, 16 cases. The medical officer of the first-named corps leaves it to be inferred that the disease was acquired at Vizianagram, which has a bad record in this respect; as regards the second regiment, it is said that as the disease is endemic in the Malay Peninsula, the sources of infection were abundant at Singapore, but in neither case is any fresh light thrown upon the etiology of the sickness. The same remark applies to the outbreak at Secunderabad, though it is said that the majority of those attacked were recruits of under one year's service, and a similar liability of young men on first arrival has been frequently remarked in previous years' reports. At Secunderabad it is also noted that the quarters occupied by the men affected were evacuated, thoroughly disinfected and kept vacant, while special attention was paid to the diet; the rice supplied was found to be good and wholesome.

Jails of India.

Sickness and mortality in 1903.—The vital statistics of the jail population in 1903 present some striking features which, inasmuch as they are the culmination of a record of consistent progress, merit a more general discussion than is usually devoted to them in the text of this section.

The climatic conditions of the year were generally normal and favourable, save in respect of some defect and irregularity of the monsoon rains in June and July, their excess in August and September, and their late continuance in October. The harvests were, on the whole, abundant, and food prices steady and slightly lower than in 1902, but the health of the free population was less satisfactory, due chiefly to increased prevalence of plague and malarial fevers, the death-rates being everywhere higher than those of the previous year save in Bengal, and they were above the quinquennial standard everywhere save in Burma. The general prosperity, which is so directly dependant on the food-supply, was marked by a very notable diminution in the jail population, the aggregate strength, which had averaged 118,485 during the previous eight years, falling to 105,729, the lowest figure since 1890. The release of convicts on New Year's Day, in commemoration of the Coronation of the King-Emperor, certainly contributed to this result, but the chief factor was the large decrease in the number admitted into jail during the year, a decrease which amounted to about 30,000 on the total for 1902. Some acquaintance with the nature of the jail population is important for an appreciation of the vital statistics.

Special influences affecting the jail population.—In the first place, the connection of poverty with crime is specially obvious in this country. A marked feature of the past decade has been an extraordinary increase in the jail population altogether out of proportion to that of the people at large, and this is chiefly due to the conditions of famine and scarcity to which they have been subject; at the same time, the accommodation in the jails is limited. Any considerable strain on the food resources is marked by an increase of crime and sickness, the available accommodation of many of the jails is taxed, the prisoners are admitted in poor physical condition, and frequently suffering from disease. On the other hand, with a return of prosperity, fewer are admitted, these are in better health, and find the conditions of jail life, as regards aggregation, very much more favourable, inasmuch as the great bulk of the sickness and mortality is due to communicable (infectious) diseases.

Again, it is frequently said that the great majority of our prisoners is drawn from the agricultural classes, but these are, of course, in overwhelming

---

* The case mortality has, however, varied from 6 to 19 per cent.

overwhelming preponderance in the free population. A study of statement II.,* giving the previous occupation of convicts, does not permit any definite conclusions to be drawn upon this question, but in 1903 only 54 per cent. of the total admitted are reported to have been "engaged in agriculture, &c.," and it would appear that an excessive proportion of criminals is drawn from the towns, where the physical standard is at its lowest and where the lower classes have suffered specially from the general rise in prices. The fact that only 13 per cent. of those admitted are "habituals" must also be considered in the light of the numerical inferiority of the urban population. Lastly, we have to deal with a flowing and fluctuating population; the total number of convicts admitted and discharged during the year amounted to nearly three times the average strength, and the number of prisoners under trial who passed through the lock-ups was equal to 25 times the average strength,—facts of cardinal importance in view of the character of the diseases and their constant introduction from without. Comparisons of the death-rates in the jails with those of the free population are subject to fallacy owing to the defective registration of mortality among the latter, and in any case, they would require correction for age and class (or economic position), but a falling rate in the jails which is synchronous with a rising rate among the people at large is obviously to the credit of the former. And this is precisely the position disclosed, equally with regard to the past quarter of a century and to the year under review, when the statistics are viewed as a whole.

The record since 1881.—The last four quinquennial periods of the century just closed yielded the following death-rates per 1,000 for all classes of prisoners combined, viz., 35·96, 33·95, 30·63, and 29·97, the last being the period of famine and scarcity and of the prevalence of plague (1896-1900). Moreover, the average population, which was only just over 90,000 in the first lustrum, rose to 114,000 in the last, an increase of over 26 per cent. The death-rates for the last three years (1901-1903) were 26·87, 24·85 and 21·38, respectively, the whole series thus showing a steady and consistent decrease of mortality, representing a very large annual saving of life. The causes of sickness have remained unaltered in character and have diminished only slightly in amount, while the condition of prisoners on admission has been less favourable and the sources of infection from without more numerous.

It has been calculated that the mortality of males of the free population in India as a whole, under ordinary conditions, is at the rate of 25·8 per 1,000 of the number at the age-period 15 to 64 years, which may be held to cover the ages of the prisoners. At present the returns do not afford data for an exact comparison of the age-constitutions of the jail and free populations, but these could easily be obtained by a census of the ages of prisoners to be taken, say, on two days in the year, and it would be advisable to institute such a census.

The fact that the death-rate among prisoners, who are drawn chiefly from the lowest and least resistant classes, has fallen so notably below the standard for the free population at the same ages, will justify this review of the present position and a more detailed analysis of the figures that may provide a clue to past and future progress.

Convicts, long and short term; comparative statement.—As regards convicts, and excluding the Andamans Settlement, for which data are not available, a comparison of the results for 1903 with those of the average of the first lustrum in the period reviewed (1881-85) shows, that while the combined death-rate in all jails has fallen from 36·9 to 19·7, or 46 per cent., the share of the district jails in this result has been 34 per cent., while that of the central jails has been 58 per cent. With this is connected the fact that the reduction of mortality has been greater among convicts who had passed over six months in jail, viz., 51 per cent., than among those who had been detained for only six months or under, viz., 41 per cent. The death-rate of short-term prisoners is consistently highest throughout, due chiefly to their condition on admission, and to the arrangements in district jails, with a flow of population equal to four times the average strength, involving reintroduction of sickness. If we distinguish among the longer-term prisoners those detained for periods between six months and three years, and those detained over three years, it is found that the death-rate of the former, from being higher in the first period,

* Provincial Reports.

has gradually fallen to the level of that of the latter (longest terms), till 1903 the figures were 17·8 and 18·2 per 1,000, respectively, which become 16·04 and 16·8, respectively, in central jails taken alone. The average strength yielding these satisfactory results amounted to 50,000, or 60 per cent. of the total population, excluding the Andamans, and it is obvious that under present conditions, there is no great scope for future improvement in the life prospects of these prisoners.

Prisoners under trial.—As regards prisoners under trial, it is to be noted that the average detention in the lock-ups is only about 14 days, and there would appear to be some disinclination on their part to report sickness, for the hospital admission rates are consistently very much lower than those of convicts in all but two provinces (Burma and United Provinces). But not more than half their number are convicted, and the non-criminals probably represent a better physical type than that of the convicts. Among all, the stimulus of the hope of speedy release probably operates against complaints of sickness in the early stages, and this may be one cause of the higher morbidity and mortality which fall upon those who are convicted, and during their first six months' sojourn in jail. This would indicate the necessity of careful enquiry into, and early treatment of, all cases of sickness in the *hawalats*.

The death-rates of the prisoners under trial for the three quinquennial periods ending 1900 were 29·65, 28·93 and 31·26, the first two comparing favourably with the convict rates, the last representing the effects of famine and epidemic disease (1896-1900). The short period of detention implies less liability to fatal results from the more chronic forms of disease, and on the other hand, it may be less complete control of these prisoners on the part of the medical officers. The death-rates for the past three years (1901-1903) are very satisfactory, viz., 21·47, 20·11 and 17·9, respectively, the last figure, as in the case of the convicts being the lowest on record.

Turning next to the chief causes of sickness and mortality among the convicts, and comparing the results for 1903 with those of the first period under review, the returns yield the following analysis:—

Convicts.—Sickness and Mortality—Comparative Statement.

Convicts in India.	Admission and Death rates per 1,000.			
	1903.		1881–1885.	
	A.	D.	A.	D.
1. Malarial fevers	381·3	1·28	450·2	2·61
2. Tubercle of lungs	10·5	4·17	5·7	2·36
3. Anæmia and debility	9·7	0·31	28·1	2·26
4. Pneumonia	14·0	3·70	52·1*	5·83*
5. Other respiratory diseases	39·3	0·82		
6. Dysentery and diarrhœa	141·6	5·02	182·7	12·92
Total (*a*)	596·4	15·30	718·8	25·99
Total all causes (*b*)	911·7	21·75	1,099·5	35·96
Per cent. of (*a*) to (*b*) ...	65·4	70·3	65·3	72·2

* All respiratory diseases, including pneumonia.

This shows that at present, as formerly, 65 per cent. of all sickness and 70 per cent. of all mortality is ascribable to the causes specified above. And further, the reduction in the mortality from these specified diseases, from other causes and from all causes, has been approximately the same, viz., 41 per cent. While the general character of the sickness remains unaltered and its amount in the aggregate has been very slightly diminished, the case mortality has been very considerably reduced.

It is important to note that the diseases specified belong to the class of specific communicable infections, and that this list does not, by any means, exhaust the number of these to which prisoners are liable.

If, now, the evidence adduced be borne in mind, notably the special liability to sickness and mortality of short-term prisoners and the constant introduction of disease into the jails, the indications for prophylaxis are clear. In the diseases that concern us chiefly, the sick man, his excreta and his immediate surroundings are the main foci of infection, the danger being enhanced in institutions by the aggregation of susceptible individuals, and by their common use of dormitories and factories, of vessels, clothing, &c. The practical measures indicated may then be summarised briefly as follows.

Preventive measures.—Prevention of the introduction of infection from outside, by careful examination and observation of all on admission, and the use of observation cells in doubtful and suspicious cases to obviate the danger of association with the community. Prompt recognition of all cases of sickness, or the prodromata thereof, at the first examination and at subsequent parades, to remove sources of infection and for treatment. The utmost practicable isolation of the sick as regards both immediate and mediate communications; with this, observation of recent contacts. Disinfection and careful disposal of all infectious excreta,* of clothing, vessels, wards, latrines, &c. Lastly, surveillance of convalescents till they are fit to rejoin the community without danger thereto. All available resources should be utilized to avoid the congregation of convalescents from different infectious diseases.

That these principles are recognized and largely applied is plain from the records; a specific example is furnished by the success which has attended the efforts to exclude plague from, and suppress it within, the jails during the last six years, and precisely the same measures apply to the other infections in varying degree. With all the provinces affected in 1903 and a recorded mortality of 865,578 among the free population, the cases discovered in the jails numbered 34, of which 23 proved fatal. Of the total number of jails, 245, no less than 159 were situated in infected towns or districts, and of these only 14 returned cases of the disease, eight jails recording only one case each. At the same time, indications are not wanting that there is still room for improvement in the application of these measures to some other prominent infections, as, for example, to tuberculosis.

Thus, an analysis of the 294 fatal cases of tubercle of the lungs which occurred among convicts in India during 1903, discloses the fact that the average duration of illness in each case, from its recognition until death, was just under 70 days. This is certainly not due to a large proportion of acute miliary cases; the case histories rather exhibit a tendency to the recognition of the disease only in its more advanced stages. Over 41 per cent. of these cases were admitted to jail in good or fair health (good, 38 per cent.), 34 per cent. in indifferent, and 24 per cent. in bad health, and in the majority of the latter categories, phthisis was not recognised as present at the time. Thirty per cent. of the deaths occurred among prisoners who had not completed six months' detention; at the same time, the effect of incarceration may possibly be traced in the death-rates, which were 2·6, 3·7 and 5·8 per 1,000 for short, middle and long-term prisoners, respectively. Much has been done, and is being done, for the segregation of these cases and their treatment on modern open-air principles. But if we are to advance on the lines indicated in respect of all infectious disease, we must look to a development of our resources, *e.g.*, the provision of more isolation wards, with self-contained equipment, and, perhaps, of disinfecting apparatus, for the central jails, in the first instance. It remains, before leaving this question of the control of disease, to note a few points of a general character that demand attention.

The problem emerges clearly when the fact is grasped that of the 2,175 deaths among prisoners in 1903, 859 (40 per cent.) were due to diseases of the lungs, including tuberculosis; 260 (12 per cent.) to the specific fevers including malaria; and 638 (29 per cent.) to specific bowel and liver complaints; total 1,757 or 81 per cent. In all three categories, air-space and effective ventilation are the cardinal indications.

---

* Preferably, destruction by fire wherever possible, and noting, in connection with the habits of natives, the infective character of the nasal, pharyngeal, and bronchial excreta, in tubercle, pneumonia, cerebro-spinal fever, leprosy, syphilis, influenza, pneumonic plague, measles and mumps.

Overcrowding and accommodation.—With the growth of the jail population, the necessity arises for an increase and improvement of the accommodation; the average strength disguises the fluctuations of the population, and local and temporary overcrowding, which must occur, presents a problem which is recognized and is partly solved by administrative measures. It is specially as regards convicts that difficulties arise, and chiefly in the provinces of Bombay and Bengal; the circumstances of the former have been very adverse during the past septennium, but in only two of the last 21 years has the present nominal accommodation been in excess of the average strength. In Bengal the most pressing problem, perhaps, is to escape from the arrangement which prevails in many of the dormitories, whereby more than two rows of berths are placed between the ventilation apertures in the opposed walls; this applies to one or several wards of no less than 24 of the 48 jails in the province, and the local authorities are fully alive to the need for reform.

Water supplies.—In the matter of water supply a most satisfactory advance has been made during recent years, in all that concerns the selection of sources and their conservancy. What still remains to be effected in a large number of jails, unprovided with good municipal filtered supplies and which depend on the ground water, is the provision of securer means of raising, of storage, and of distribution, commencing with the pump and the closed well and ending with taps at the necessary points. With this goes also the exclusion of all unauthorised sources from access by the prisoner.

Diet.—And, thirdly, in the same connection, some allusion must be made to the question of diet, a complete discussion of which would greatly exceed the limits of available space on this occasion. That the standard rations are more than ample in amount and excellent in quality is beyond doubt, as proved by a calculation of their theoretical values and by experience; in the year now under review 60 per cent. of the prisoners discharged had gained weight, 16 per cent. only had lost weight. But that 40 per cent. derived no advantage in view of the very large excess of theoretical food-value supplied over the standard laid down by the best authorities, raises the question of the justification of this excess, and its general adaptability to the needs of all classes of prisoners, *e.g.*, to non-labouring prisoners, to those on light labour and to all during the first few months of detention. It is significant that dysentery and diarrhœa, which claim so many victims, are fatal to prisoners in inverse relation to the length of their incarceration. Fifty-six per cent. of the mortality in 1903 fell upon those who had served a term of six months or less, *i.e.*, on 40 per cent. of the average strength; 32 per cent. of the mortality was incurred by those detained from six months to two years, or 37 per cent. of strength; and 12 per cent. by the rest, or 23 per cent. of the strength. Part of the excessive incidence on the first period was due to the condition of prisoners on admission, but 112 of the cases were admitted in good health, 126 in indifferent, and 113 in bad health. Without entering here upon a technical discussion of the relative proportions of the food elements provided in the dietaries, a question which is receiving attention, it may be noted that convicts sentenced to labour receive on the average about 20 ounces of carbohydrate, while those undergoing simple inprisonment obtain 17 ounces, which amounts yield theoretical values of 2,300 and 1,980 kilo-calories, respectively. This is altogether apart from the supply of proteid, which exceeds the standard, and that of fat which may be deemed scarcely sufficient. It has to be noted that the majority of our prisoners are suddenly withdrawn from life and labour in the open air, where starchy food can be disposed of more or less adequately; and further, that the standard of body weight, at 110 lbs. is only three-fourths of that of the European, for whom the best authorities lay down a supply of carbohydrate of 17½ ozs. (kilo-calories, 2,050) for ordinary labour. While taking the different climatic conditions into account and the inevitable waste that is involved in the use of a cereal and vegetable diet, it must still be apparent that waste will not be amended, but rather augmented, by an undue excess of an element, which is the least digestible in the form provided, both by the method of cooking employed and by the amount of cellulose it contains. It can scarcely be doubted that an undue strain is placed upon the intestines and the lungs, and further, that acid fermentation is set up which interferes with the due absorption of proteid, the loss of which is detrimental to the function of the tissues in resistance to disease. The case is not one, however, for arbitrary decision off-hand, but for consideration and

careful study; here, as in other matters, it is necessary to revise our procedure in the light of experience and modern knowledge. For the rest, progress will be the fruit of careful adaptation of measures to circumstances, and an intelligent devotion to details. A brief account may now be given of the conditions prevailing in the different administrations in 1903, and the usual details will be found in the tables in the appendix.

Prisoners.

Administrations.	Years.	Average Strength.†	Ratio per 1,000 of Strength.*											
			Admissions.	Constantly Sick.	Deaths from									
					Cholera.	Small-pox.	Remittent Fever.	Tubercle of the Lungs.	Pneumonia.	Other Respiratory Diseases.	Dysentery.	Diarrhœa.	Anæmia and Debility.	All Causes.
Andamans ...	1896–1900	10,975	1,689	51	—	—	3·17	5·50	2·48	1·02	10·04	2·26	2·00	32·31
	1902	12,907	1,797	56	—	—	3·80	9·61	4·34	1·78	13·87	1·86	—	42·07
	1903	13,037	1,880	67	—	—	1·38	8·51	5·06	1·23	7·44	2·07	—	34·21
Burma ...	1896–1900	13,127	626	30	2·00	·14	·44	3·84	2·04	·43	4·27	·90	·46	20·54
	1902	11,525	537	25	—	—	·43	3·82	1·65	·87	2·95	·43	·26	15·88
	1903	11,187	474	21	·63	—	·27	3·22	2·15	·36	3·22	·89	·54	17·07
Assam ...	1896–1900	1,284	961	49	4·67	—	2·65	1·40	2·65	1·71	8·88	4·05	3·58	44·24
	1902	1,220	762	40	·82	—	2·46	2·46	3·28	—	7·38	—	3·28	31·97
	1903	1,134	737	34	2·65	—	—	1·76	·88	—	13·23	2·65	4·41	31·75
Bengal ...	1896–1900	18,121	1,067	37	2·40	·03	·96	3·77	3·60	·91	7·76	1·57	·96	30·11
	1902	20,580	1,034	41	·53	·05	·39	3·50	3·06	·53	6·12	1·55	·92	25·61
	1903	18,419	1,046	40	1·09	·05	·27	4·40	3·31	·43	5·05	1·36	·43	23·62
United Provinces of Agra and Oudh.	1896–1900	32,128	883	45	·47	·07	·47	2·71	4·86	1·00	6·09	2·04	2·66	27·86
	1902	27,751	735	35	·32	·04	·14	3·35	2·20	·76	4·94	1·77	·07	20·47
	1903	23,141	701	34	·56	·09	·04	2·59	2·46	·65	2·85	48	·13	15·56
Punjab ...	1896–1900	12,081	1,253	33	·22	·10	·55	2·83	4·87	·74	3·24	·96	·36	19·83
	1902	12,782	1,136	35	—	·22	·70	4·46	5·71	·55	2·74	1·17	·86	25·04
	1903	12,163	938	30	·25	·16	·41	3·12	4·69	1·23	2·22	·41	·25	19·16
North - West Frontier Province.	1896–1900	1,178	1,225	41	—	—	1·87	·68	4·24	1·02	2·21	1·87	—	19·35
	1902	1,290	975	32	—	—	—	2·33	7·75	—	5·43	·78	—	29·46
	1903	1,287	1,087	33	—	—	—	—	3·89	—	1·55	·78	1·55	15·54
Bombay ...	1896–1900	8,759	773	29	3·27	·09	2·44	2·74	6·12	1·35	3·27	3·04	1·46	33·72
	1902	9,898	648	31	—	—	·91	3·44	5·76	1·72	1·62	2·63	1·01	28·89
	1903	7,800	515	24	—	·13	·38	3·20	8·20	1·67	1·92	1·03	·38	26·41
Central Provinces. (*a*)	1896–1900	7,142	975	39	3·19	·20	1·04	3·58	5·29	2·10	25·65	8·32	4·68	66·18
	1902	5,222	930	29	—	—	·19	3·06	3·26	·96	4·02	2·30	·77	23·55
	1903	4,075	816	27	—	—	—	2·45	1·47	1·23	2·94	·98	1·47	18·16
Madras ...	1896–1900	8,870	646	27	5·30	·11	·14	3·56	2·37	·54	4·10	·05	·34	28·30
	1902	10,382	469	22	·29	·10	·10	3·85	2·02	·10	1·83	·10	·58	18·49
	1903	8,853	426	20	1·24	—	·23	3·16	2·82	·34	1·92	·11	·34	19·20
India‡ ...	1896–1900	114,293	981	33	1·68	·08	1·03	3·35	4·02	·94	7·04	2·10	1·67	29·97
	1902	114,334	913	35	·21	·05	·78	4·25	3·38	·85	5·13	1·44	·52	24·85
	1903	101,717	889	35	·56	·06	·36	3·85	3·62	·78	3·73	·93	·38	21·38
	1891–1900	103,606	1,024	39	1·99	·08	1·20	2·98	4·27	1·09	6·81	2·18	1·78	30·29

* Excluding subsidiary jails.

† The quinquennial and decennial ratios are, of course, worked on the total strength of the five-year and ten-year periods respectively.

‡ Including Ajmer, Quetta, Mercara, and Secunderabad.

(*a*) Including Berar.

Burma.—Although there was an increase in the number of admissions of all classes of prisoners, the daily average strength was lower than in 1902; in this respect there has been a steady decline during the past five years. The ratios of admission to hospital and of daily sick were the lowest on record, but the death-rate rose to 17·07 per 1,000 from 15·88 in the previous year. This is accounted for by the increased mortality from cholera, pneumonia, dysentery and diarrhœa, enteric fever, and anæmia and debility. On the other hand, it is satisfactory to note a decrease in the prevalence and fatality of tuberculosis for which there were 88 admissions and 39 deaths against 121 and 46, respectively, in 1902. Of the total number, 60 cases, of which 25 were fatal, occurred in central jails, but in 15 of the 32 jails no case was recorded. There were 8 cases of enteric fever, of which 7 proved fatal; a case mortality which would seem to suggest that non-fatal cases escape diagnosis, but the number is too small for any decisive inference. The highest death-rates occurred in some of the smaller district jails, where the average strength is low and a few deaths give a high ratio. On the other hand, the aggregate death-rate in the central jails accommodating over three-fifths of the population, amounted to only 14 per 1,000, the only considerable mortality occurring in Mandalay (30·13), and here 10 of the 21 fatalities were ascribed to dysentery, for which the water supply is held responsible. It has been derived hitherto from a moat subject to pollution, and every endeavour has been made to render it innocuous by boiling and filtering. This has now been excluded from use, and a reputed good and wholesome supply obtained from an artesian well. One further comment may be made on a satisfactory report: a perusal of column 18 in Statement A, in the Appendix of the Provincial Report would appear to show that in many of the jails the site area is unduly restricted; this is an important matter which deserves attention.

Assam.—With a slight rise in the total number of prisoners admitted there was a decrease in the average strength, and the ratios of admission to hospital and of constantly sick were the lowest on record; the death-rate was, however, about the same as in 1902, viz., 31·75 per 1,000 against 31·97, the mean for 1896-1900 being 44·24. There were altogether 36 deaths recorded in 1903, of which 33 occurred in three jails, Tezpur (14), Gauhati (10) and Sylhet (9), in which three-fourths of the average strength were confined, and the marked feature of the mortality was the high rates from bowel complaints, dysentery and diarrhœa, accounting for 18, and cholera for 3 deaths. To the former number Tezpur contributed 11 deaths, and to the latter, one, and with an average strength of 210, the total death-rate in this jail was 66·67. While giving due weight to the condition in which prisoners are admitted, there can be little doubt that this record, which places the Assam jails in an unenviable and unapproached position at the head of the list of mortality from bowel complaints, is a subject for concern, and for reform in regard to all preventive measures. The death-rate in Sylhet, the largest jail, fell from 31·89 in 1902 to 21·74 including one death only from dysentery and one from cholera; this is so far satisfactory, but one can scarcely say it represents what is described as a state of "extreme healthiness," when in addition to the deaths taken into account, it is said that five cases were discharged from jail on account of serious sickness.

Bengal.—There was a decrease in the daily average strength amounting to 2,161 as compared with 1902, but this did not preclude overcrowding, from time to time, in many of the jails; even where the authorized number was not exceeded, the dormitory arrangements frequently involved all the results of overcrowding; it is also doubtful if the site area in many cases be not dangerously restricted. The ratio of admissions to hospital was very slightly higher, of the daily average sick distinctly lower, than in the previous year, while the death-rate fell from 25·61 to 23·62; the rate for convicts in the central jails, accommodating more than half the total population, was only 17·5 per 1,000. This was due to a general improvement as regards all causes of sickness and mortality save tubercle of the lungs and cholera, which show an increase of 12 and 6 fatal cases, respectively. The diminution in prevalence and fatality of dysentery is satisfactory, but it also serves to direct attention to a few jails, where this scourge of the free population of Bengal found favouring conditions, which the authorities recognize and are concerned to reform. The increase of tuberculosis furnishes support to the Inspector General's criticism of the accommodation in barracks and on the site, for those accustomed to work in the open air and whose dwellings have the qualities of their defects of

perviousness. Among the convicts the death-rate from this cause was 4·8, which is exceeded by the Andamans only; in central jails the rate was 5·5; and in district jails 4·2, an advantage determined probably by the shorter terms of confinement in the latter; segregation and open-air treatment are being carried out as far as circumstances permit, but early diagnosis is essential. In the same connexion it may be noted that the pneumonia death-rate shows but little sign of improvement during the last few years. Cerebro-spinal meningitis, which has been a feature of the returns from Bhagalpur in recent years, is said to have "practically disappeared," there having been only two cases and one death in 1903. There were 17 cases of plague, with 12 deaths, and it is noted (and this applies to so many other infectious diseases) that means for enforcing "quarantine" do not exist in most jails, and this necessitates the erection of temporary huts, a costly and insecure expedient.

United Provinces.—There was a notable decrease in the average population in confinement, amounting to 4,610 as compared with 1902, of nearly 7,000 as compared with 1900. Overcrowding was practically obviated, and this also had the result of largely decreasing the number of transfers between jails. The ratios of admissions to hospital and of constantly sick were much below the average, and the death-rate, 15·5 against 20·47 in the previous year, was the lowest on record for the Province, and for India in 1903, if the small North-West Frontier Province be excepted, from which the same rate was returned. There was a decrease in the prevalence and fatality of most of the chief disease causes, and notably of tuberculosis and dysentery and diarrhœa, perhaps the best testimony to the success of the administration and executive, when the very considerable rise in the mortality of the free population is considered. Among the convicts in the central jails, which accommodated nearly half the total average strength, the death-rate was only 12·9 per 1,000, and this falls to 10 per 1,000, if one jail, Agra, be excluded, in which an unusual outbreak of cholera occurred. In some of the district jails where the results were less brilliant, there is a constant reference to the introduction of disease from without, and this should serve to point the application of the remarks made in a former part of this report; the exemplary success obtained in these provinces is, indeed, largely the result of the measures set forth, together with the increased accommodation rendered available by the diminished population.

Punjab.—The daily average strength of all classes of prisoners was slightly lower than in 1902, and there was no notable overcrowding save in three jails, of which two were central. It is said that under no circumstances are dormitories overcrowded, "but the margin of accommodation is far short of what it ought to be." The ventilation of the dormitories and cells in several of the larger jails has recently been improved, and there is ample evidence in every direction of constant progress in the amelioration of the hygienic conditions, and no province can show comparable results in the steady decline of mortality during the last quarter of a century. In 1903 the ratios of admissions and constantly sick were well below the average, and the death-rate fell from 25·04 per 1,000 in 1902 to 19·16, while that of the free population rose from 44 to 49 per 1,000. With cholera and plague widely prevalent outside, there were only two deaths from the former and one from the latter in the jails during the year, but it is remarked that the arrangements for the disinfection of clothing and bedding, the contamination of which promotes the spread of all forms of infectious disease, are far from satisfactory. All the chief causes of sickness and mortality were less prevalent and less fatal, although certain jails are subject beyond others to the occurrence of pneumonia and of tuberculosis, about half the total mortality from the former being reported from 5 of the largest district jails holding one-fourth of the total strength, while 23 deaths out of 38 from the latter cause occurred in three central jails, accommodating a little more than one-third of the population. The decline in the rates from dysentery and diarrhœa taken together is a very satisfactory feature of the year's work, the mortality in the last three years yielding ratios of 5·7, 3·9 and 2·6 per 1,000 respectively.

North-West Frontier Province.—There was a daily average strength of only 1,280 prisoners of all classes, confined in the five jails of this area during the year, a slight increase on the number for 1902. There was overcrowding at Bannu and Kohat for nearly half the year, and at Abbottabad and Peshawar it was also noticeable; this necessitated the accommodation of the excess in tents, in workshops, in the hospital verandahs and cook-house, which is most undesirable. Nevertheless,

the general health of the prisoners was good, for, with an insignificant rise in the sickness rate, there was a fall in the death-rate from 29·46 to 15·54. There was a decrease in the admissions from all causes save malaria, which was specially prevalent at Dera Ismail Khan, and the mortality calls for no special comment.

Bombay.—There was a great extension of the plague epidemic among the free population which in other respects was somewhat better off both as regards general health, and material circumstances, owing to good harvests and lower food prices. The average strength of prisoners of all classes was less by about 2,000 than in 1902, and yet of the 14 jails (excluding the "gangs") in the Presidency and Sind, 10 were overcroweded throughout the year, and one more was subject to temporary overcrowding. This is a serious situation, not of a temporary or accidental nature; it is a standing disability which is bound to leave its mark on the vital statistics, inasmuch as all preventive measures operate at a disadvantage. The record for the year under review presents, however, many signs of improvement; the ratios of admissions to hospital and of constantly sick fell to a point which is very low when the death-rate is considered, viz., 26·41 against 28·89 in the previous year, and this is attributed to the better condition of prisoners on admission and to the decrease in their numbers. There was less sickness under most of the main heads save respiratory diseases, less mortality from all causes save pneumonia. As is to be expected under the conditions prevailing, diseases of the lungs are more frequent and fatal here than elsewhere; while the mortality rate for India as a whole from tuberculosis, pneumonia and other lung diseases combined is 7·3, it rises to 13·07 in Bombay, due to the excess returned under the latter two heads. Among the convicts in Sind, with an average strength of 1,617, there were 90 deaths (a rate of 55·6 per 1,000) of which 59 were due to these causes, and 49 to pneumonia alone, to which last the small Sind gang contributed 33. The ventilation of the barracks which have roofs of reed mats is said to be good, but the space area per man is only 28 square feet and 280 cubic feet, and it is difficult to see how ventilation in the winter (in Sind) can be adequate without involving dangerous draught. Moreover, the men were locked up earlier at night and the barracks evacuated later next morning to avoid the cold and, with it, the fresh air. The first essential in the prevention of pneumonia is ample ventilation, and for this, ample space; and with adequate clothing the temperature of the air may be disregarded. The two prisons in Bombay City are structurally very defective and were badly overcrowded; the combined death-rate of the native convicts amounted to 56·6 per 1,000, but as the matter is understood to be receiving the attention of the Local Government, any further discussion of it may be deferred.

Central Provinces.—Berar having been incorporated administratively with this area, the jail statistics of both will henceforth be discussed under this heading. The recovery of the people from the results of famine is plainly marked in the great diminution of crime, the daily average strength of all classes of prisoners fell in 1903 to less than half the number confined during the famine (1897), to a point below the lowest previously on record. In spite of this there was overcrowding of convicts, more or less temporary, in five of the jails, and additional accommodation is required for prisoners under trial. The improvement in the health of the prisoners was marked both in regard to sickness and mortality, and this is the case in respect of nearly all the main causes of disease. The death-rate for the period 1896-1900 was 66·18, falling to 23·55 in 1902, and again to 18·16 in the year under review, and this with a rise of about 8 per 1,000 in the death-rate among the free population. This happy result is largely due to the diminished mortality among convicts reported from Jubbulpur Central Jail, though Nagpur Central and the District Jails, as a whole, also show to advantage, if in less degree, having less leeway to recover. The success which attended the exclusion of plague from the jails was equally satisfactory; although the disease was epidemic in 12 headquarter towns, only three cases with one death were recorded among the prisoners.

Madras.—A prosperous year for the people at large resulted in a great decrease in the number of prisoners admitted, and the average strength of all classes confined fell by over 1,500 below the number in 1902. The accommodation in only three of the jails was found insufficient for the local demands, and the disability was reduced by transfers. The general health of the prisoners was very good as shown by the

hospital admission and constantly sick-rates, and far below the average both for the Presidency and for India as a whole. The death-rate amounted to 19·20 per 1,000 against 18·49 in 1902, and 28·3, the mean for the quinquennium 1896-1900, the slight rise over that of the previous year being due to cholera which accounted for 11 deaths (against 3 in 1902), 7 of which occurred in one jail, Berhampur. There is little that calls for comment in this favourable record save to remark the extraordinarily low death-rate from dysentery to which the convicts, in the central jails especially, were subject. In these institutions 65 per cent. of the total convict population is confined, and the mortality from dysentery in 1903 amounted to only 1·7 per 1,000 of strength against 3·73 for India as a whole. At the same time the death-rate from diarrhœa is just over double the average elsewhere, so that if the rates are combined, there is little variation from the mean. The post-mortem records support the view that the term "dysentery" is used in a restricted sense in Madras, when compared with the usage elsewhere, and that the lower death-rate does not connote any special immunity to a form of disease which often presents difficulties to exact discrimination. The relative immunity of the large jails of Rajahmundry and Cannanore to all forms of bowel complaints is exceedingly creditable to the officers, or officer, concerned.

Andamans.—In 1903 rain fell to the amount of 116 inches, about the average of the previous lustrum, but fully 22 inches below the total for 1902; it fell on 181 days out of the 245 from May to December, *i.e.*, on three days out of four during eight months. A steady increase in the convict population is to be noted during the last nine years, the average strength during 1896-1900 was 10,975, rising to 12,907 in 1902, and to 13,037 in 1903; the large decrease in crime and in the jail population in India had not yet affected the Settlement. "Many of the barracks are now filled to their utmost capacity"; the local Jail Manual provides for a maximum allowance of cubic space per unit (648 cubic feet), but this appears to be rarely or never attained, and the minimum is uncertain, the only standard maintained being that of floor space (36 square feet), and yet the convicts are aggregated in four rows in the dormitories, an arrangement which renders efficient ventilation incompatible with exclusion of rain. The increase in recent years of the criminal population of the Andamans has not been met by a corresponding increase of accommodation, but improvements in this direction and in the food and water supplies are in progress.

The ratios of admissions to hospital and of constantly sick have been recently nearly twice as high as those prevailing among convicts in India, and the mortality rates for the past three quinquennia were 38·5, 27·8 and 39·08 per 1,000 respectively. In 1903 the ratios are: admissions to hospital, 1,880; constantly sick, 67; deaths, 34·21; against 1,797, 56 and 42·07 per 1,000 respectively, in 1902. But if a distinction is made between "self-supporting" and "labouring" convicts, with an average strength of about 2,000 of the former to 11,000 of the latter, it is found that, on the average of the past 5 years the constantly sick-rate was fully 8 times and the death-rate nearly two and a half times greater among the latter class, or, as 66 to 8, and as 41 to 17. As regards sickness, malarial fevers account for about 60 per cent. of the total, bowel complaints for 11 to 12 per cent., and respiratory disorders including phthisis for 6 to 7 per cent.; the mortality falling in reverse order, lung diseases yielding 40 to 45 per cent., bowel complaints 30 to 40 per cent., and malaria 7 to 11 per cent. of the total. The problems which this bare statement discloses have recently received detailed study by the medical officers on the spot, and if the measures proposed could be carried out consistently in their entirety, and with adequate authority and resources, there can be little doubt of the results. These measures were summarised in the report furnished last year, and the hope may be expressed that their effects are visible in the reduction of the mortality from malarial fevers and dysentery to nearly one-half of the amount of the previous year, while there have been 17 less deaths from respiratory diseases, including 14 from pulmonary phthisis—184 against 201. This is decidedly encouraging to sustained and strenuous efforts, even if the desired end tarry, and there are circumstances in the life conditions of the labouring convicts of peculiar difficulty. They are exiles, they are put to unaccustomed labour and exposed to stress of weather, of which some indication has been given; it cannot, therefore, be anticipated that the vital statistics will compare favourably with those of convicts in India. Finally, it would be well to modify the form of the Annual Report on the lines of the Indian Adminis-

trative Reports; many points would receive elucidation that are at present doubtful and unexplained, and every measure that contributes to the marking down of the causes and incidence of sickness will promote the end in view.

Coorg, Rajputana, Baluchistan, Secunderabad.—There was a very considerable improvement in the health statistics of these small jails; in all save that of Secunderabad, the constantly sick-rate was lower than in the previous year, but here and in the Quetta jail there were no deaths recorded in 1903. At Ajmer the death-rate per 1,000 of an average strength of 420 was only 7·14 against 29·57 in 1902, and at Mercara it was 13·89, or just about one-third of the previous year's rate. These fluctuations call for no comment as they are inevitable in the case of institutions the average strength of the inmates of which does not amount to 100, save in the case of Ajmer.

Epidemic disease.—In conclusion, a few words will suffice to indicate the prevalence of the chief forms of acute epidemic disease to which the jail population was liable during the past year. Cholera was more prevalent among the free population than in 1902, and the returns from the jails show a rise from 36 cases and 24 deaths in that year to 97 and 57, respectively, in 1903. The only considerable outbreaks were in the jails at Berhampur (14 cases), Agra Central (12), and Angul (11), the rest of the cases being distributed among 26 jails, Bengal, Madras, Burma and the United Provinces sharing the largest number. The admission rate for India was 1·0 per 1,000 of strength, and the death-rate ·56, a result which is in accordance with the steady diminution during the last half century. Small-pox was also slightly more prevalent with 62 cases and 6 deaths against 47 and 6, respectively, in 1902; the disease appeared in 30 jails, Dera Ghazi Khan returning 8 cases, Gauhati 6, and Fyzabad 5; the death-rate per 1,000 of total strength was .06, or about the quinquennial average. Influenza caused about the same amount of sickness as in the previous year, 977 cases against 912, with 13 against 16 fatalities, the disease being most prevalent in the Central Provinces, Bengal, Andamans and the United Provinces. The success which attended the exclusion of plague from the jails during the year has been alluded to (page 75). It is also satisfactory to record a marked decrease in the occurrence of cerebro-spinal meningitis, the number of cases and deaths reported during the last three years being 141 and 102, 136 and 108, 34 and 27, in 20, 19 and 14 institutions, respectively. The pathological records scarcely afford conclusive evidence that all these cases were the result of infection by the specific meningo-coccus; influenza, pneumonia and tubercle were, one or more, present in the jails and cannot be excluded from the etiology in some instances. Relapsing fever, which has been a feature of the Bombay returns since the famine, accounted for 102 cases of which 8 proved fatal; all but 7 of the cases, and all the deaths, occurred in the two jails in Bombay city; in the previous year the Presidency returned 218 cases with 4 deaths among the prisoners. The diagnosis of enteric fever was made in 45 cases, of which 25 proved fatal, and on the whole, it is supported by the post-mortem records, and in a few cases confirmed by the Widal and bacteriological tests. The disease appeared in 28 jails, of which 21 had only one case each, a fact which militates against the discovery of its origin, as to which, indeed, medical officers have little unequivocal evidence to offer, and in most cases they are altogether at a loss for a clue, beyond that of some chance fæcal infection. There were 6 cases (2 fatal) of beri-beri in 1903, shared equally between Burma and Assam. Epidemic dropsy was practically confined to one jail, Barisal, which returned 26 cases with 8 deaths, the continuation of an outbreak in the previous year. Lastly, the prevalence of mumps, confined chiefly to Bengal, the Punjab and the United Provinces, showed a decrease from a total of 1,368 cases in 1902 to 449 in the year under review.

The General Population.

Births in India.—In 1903, among the census population of 226,831,150* under registration in the British provinces of India, there were recorded 8,736,652 births, or 54,562 less than in the previous year. The number of births declined in seven provinces, but in Assam, the United Provinces, Madras, Coorg and Lower Burma the numbers increased, the increase being specially remarkable in Madras where a larger number of births were recorded in 1903 than in any previous year. The mean birth-rate of the whole population was 38·96 per 1,000, as compared with 39·38 in 1902, the birth-rates ranging in the various provinces from 46·13 in the United Provinces to 29·48 in Ajmer-Merwara and 26·51 in Coorg. In eight provinces the birth-rate was higher than the death-rate, the excess being greatest in the Central provinces and Berar, 9·59 per 1,000; Lower Burma, 9·41; Assam, 9·02; and Madras, 9·01. In Bombay, where the death-rate attributed to plague was 15·22, the total death-rate exceeded the birth-rate by 12·69 per 1,000; in the Punjab, where the plague death-rate was 10·22, the excess of deaths over births was 6·1 per 1,000; in Coorg, the number of births recorded was very small; and in Upper Burma the registration of births seems to be much more defective than the registration of deaths. The mean percentage of male and female births recorded was 106·6, ranging from 127·7 in Sind and 122·8 in the North-West Frontier Province to 103·9 in Madras.

Deaths in India.—The total number of deaths registered was 7,881,125, or 768,789 more than in 1902. The mean general death-rate was 34·7 per 1,000, as compared with 31·49 in 1902. In Bengal the death-rate was slightly less, and in Assam and Ajmer-Merwara it was considerably less than in 1902; in all the other provinces the death-rates of 1903 were higher than the death-rates of 1902, the excess being greatest in the United Provinces and the Central Provinces. In every province, except Assam, the urban were higher than the rural death-rates, but in Madras, where there was a sudden great improvement in registration in rural areas during the year, the excess was only 2 per 1,000.

The largest number of deaths recorded in one month was 753,663 in November, but in the Central Provinces and Berar alone among the provinces was the maximum mortality recorded in that month. The smallest number of deaths were recorded in the month of February, but this was due to the shortness of the month, for the mean number of deaths recorded in the day was lower in August (18,954) and July (20,276) than in February (20,750). In December the maximum mortality was recorded in Bengal, Assam, the North-West Frontier Province, Ajmer-Merwara and Madras; and in February the minimum mortality was recorded in Assam, the United Provinces, Coorg, Lower Burma and Upper Burma. In January mortality in Bombay was at its highest. In April the maximum mortality was recorded in the Punjab, and the minimum in the North-West Frontier Province. June was the month of highest mortality in the United Provinces, and of lowest mortality in Bombay. July was the month of highest mortality in Lower Burma and Upper Burma, and of lowest mortality in the Central Provinces and Berar and in Ajmer-Merwara. In August occurred the largest number of deaths in Coorg, and the smallest number of deaths in the Punjab. In October the mortality in Bengal was at its lowest.

In the United Provinces, the Punjab, the North-West Frontier Province, Bombay and Ajmer-Merwara the death-rates of females were higher than the death-rates of males, the excess of female mortality being most notable in the Punjab where it amounted to 8·5 per 1,000.

Cholera was most fatal in Bengal (death-rate 2·73 per 1,000), Assam (1·58) and Upper Burma (1·0); and small-pox in the North-West Frontier Province (1·35), the Punjab (·78) and the United Provinces (·46). The highest death-rates from plague occurred in Bombay (15·22), the Punjab (10·22), the Central Provinces and Berar (4·13) and the United Provinces (1·77). Respiratory diseases were most fatal in the provinces which suffered most severely from plague, but the death-rate in the Punjab (3·38) was slightly higher than the rate in Bombay (3·21); the Central Pro-

* The population under registration for births numbers 224,239,195. This is due to the registration of births in Upper Burma being at present limited to 12 towns,

vinces and Berar (1·36) and Ajmer-Merwara (·57) followed, and the rate in the United Provinces (·50) was equalled by the rate in the North-West Frontier Province (·50).

The death-rates from dysentery and diarrhœa were highest in Bombay (3·0), the Central Provinces and Berar (2·66) and Assam (1·99); and the highest rate recorded under fever was in the United Provinces (27·65), where measles was unusually prevalent.

Birth and Death Statistics.

Province.		Births.			Number of Deaths.			Ratio of Deaths per 1,000 of Population.			Mean Death-rate during previous 5 years.			Number of deaths of males to every 100 deaths of females.
		Total number.	Ratio per 1,000 of population.	Mean ratio per 1,000 of population during previous five years.	In municipalities and towns.	In districts, excluding towns.	Total.	In municipalities and towns.	In districts, excluding towns.	Total.	In municipalities and towns.	In districts, excluding towns.	Total.	
Bengal	1902	2,987,800	40·14	37·19	133,416	2,355,012	2,488,428	35·98	33·30	33·43	33·31	30·38	30·53	112·
	1903	2,903,191	39·00	38·17	136,018	2,345,131	2,481,149	36·39	33·17	33·33	33·73	30·77	30·92	108·
Assam	1902	180,475	34·21	32·21	3,075	149,995	153,070	28·52	29·03	29·01	40·58	33·58	33·90	109·77
	1903	187,669	35·57	32·90	2,821	137,248	140,069	26·17	26·56	26·55	33·57	30·09	30·16	107·64
United Provinces of Agra and Oudh.	1902	2,186,201	45·84	39·65	157,903	1,394,143	1,552,046	46·69	31·46	32·54	41·12	31·83	32·48	106·66
	1903	2,200,031	46·13	42·60	186,008	1,734,895	1,920,903	54·86	39·16	40·28	*40·51	30·16	30·91	105·98
Punjab	1902	880,477	43·8	40·0	98,481	788,492	886,973	49·39	43·53	44·11	36·72	33·38	33·71	100·
	1903	862,862	42·9	40·7	106,539	878,937	985,476	52·89	48·58	49·0	39·70	36·35	36 72	97·6
North-West Frontier Province.	1902	66,904	33·6	30·7	4,528	44,096	48,624	27·57	24·14	24·43	28·14	24·12	23·7	111·
	1903	62,866	31·6	31·3	5,392	51,147	56,539	32·83	28·0	28·40	27·27	23·13	23·31	108·3
Central Provinces and Berar.	1902	626,728	50·17	†	41,139	300,293	341,432	33·85	26·62	27·33	‡42·47	†	†	109·4
	1903	563,548	45·11	37·18	79,106	364,591	443,697	64·59	32·36	35·52	†	‡30·40	33·30	107·44
Madras Presidency.	1902	1,023,146	28·2	28·9	101,399	631,038	732,437	28·2	19·3	20·2	31·2	21·5	22·2	104·
	1903	1,165,080	31·2	28·8	112,887	713,776	826,663	27·3	21·5	22·2	30·5	20·4	21·2	102·9
Coorg	1902	4,319	23·91	20·67	563	4,324	4,887	36·92	26·15	27·06	43·27	33·92	39·12	122·74
	1903	4,787	26·51	21·54	744	4,932	5,676	48·79	29·83	31·43	44·58	29·84	31·08	118·55
Bombay Presidency.	1902	631,393	34·16	30·57	145,524	575,938	721,462	60·22	35·85	39·04	65·77	39·08	42·40	104·
	1903	576,949	31·22	30·72	144,675	666,850	811,525	59·87	41·51	43·91	66·47	38·75	42 22	104·
Lower Burma ..	1902	175,106	31·57	34·68	19,882	97,504	117,386	29·93	19·97	21·16	32·52	24·80	25·79	128·
	1903	184,561	33·54	34·38	21,821	110,946	132,767	32·33	22·98	24·13	31·92	23·40	24·48	128·
Upper Burma ..	1902§	11,458	38·0	†	9,014	40,905	49,919	29·95	15·82	17·30	†	†	†	98·
	1903‖	11,047	37·48	†	11,554	51,387	62,941	39·20	19·83	21·80	†	†	†	96·
Ajmer-Merwara	1902	17,207	36·08	28·13	5,296	10,376	15,672	40·85	29·88	32·86	68·99	48·69	52·11	110·1
	1903	14,061	29·48	27·67	5,316	8,404	13,720	41·01	24·20	28·77	62·21	49·65	53·06	109·9

* Excluding Tundla Town. † Not available. ‡ For Central Provinces. Information for Berar not available.
§ Statistics of births for 13 towns only. ‖ Statistics of births for 12 towns only.

In the following paragraphs will be found the principal details of registration in the various provinces.

Bengal.—In 1903 the number of births recorded in the 724 registration circles in Bengal was 2,903,191, or 84,609 fewer than in the preceding year, and the birth-rate of the province was 39·0 per 1,000, as compared with 40·14 in 1902 and a mean quinquennial rate of 38·17. Among the districts the highest birth-rates were 50·91, 47·55 and 47·42 recorded in Gaya, Noakhali and Monghyr, respectively, and the lowest recorded were 30·53 in Howrah, 28·88 in Hooghly and 15·54 in the urban district of Calcutta. In ten of the towns, including Tikari (53·90) in Gaya, Dumka (48·06) in the Sonthal Parganas, and Nawabganj (46·95) in Malda, rates in excess of 40 per 1,000 were recorded, but in no less than eighty-five towns the registered rates were below 25, so that the mean urban rate was only 23·74 as compared with 39·81 in rural areas. The mean percentage of male to female births was 105, ranging in the districts from 112 in Howrah to 101 in Gaya.

The recorded deaths during 1903 aggregated 2,481,149, or 7,279 fewer than in 1902, and the death-rate was 33·33 per 1,000, against 33·43 in the previous year and a mean of 30·92 in the previous five years. Among the districts, the highest

rates were 48·73, 46·77 and 45·98 recorded, respectively, in Saran, Patna and Shahabad, all districts in which plague was prevalent; while the lowest rates were 23·51, 23·41 and 19·30 recorded, respectively, in Tippera, Ranchi and Singhbhum. The mean death-rate of the towns was 36·39 against 33·17 in rural areas. The higher mean rate in the towns was due to the greater prevalence in them of plague; excessive rates such as 78·23 in Revelganj, 76·24 in Patna City and 72·34 in Barh being due to the presence of plague; but the mean urban mortality was largely reduced by the effects of bad registration or peculiar conditions in many towns where the birth-rates also are very low, *e.g.*, Ranchi, death-rate, 9·08; Nasirabad, 8·52; and Jhalakati, 4·96.

Among the different sects, the Hindu death-rate was the highest, 34·55, and the Christian the lowest, 19·07; Muhammadans, 32·06, "other classes," 24·53, and Buddhists, 23·49, occupying intermediate positions.

The death-rates among male and female infants were 203·5 and 185·1 per 1,000 born during the year; and boys and girls between one year and five years of age died at the rate of 50·10 and 44·12, respectively. At all the age periods, except 15-20, the male death-rates were the higher, the male death-rate at all ages being 34·87 against a female rate of 31·80.

Port of Calcutta.—A total of 20,253 European seamen arrived in the Port of Calcutta during 1903, giving a daily average population of 1,145 against 1,154 in 1902. The death-rate in 1903 was less than half that of the preceding year, and considerably lower than the rate in any of the four preceding years. The number of deaths was only 10, including four from cholera, as compared with 23, including 13 from cholera in 1902; the ratio of deaths for the two years were 8·73 and 19·93 per 1,000, respectively.

The total number of deaths in and out of hospitals, during 1903, among the estimated native floating population of 25,630, amounted to 152 against 138 during 1902, the ratios being 5·93 and 5·37 per 1,000, respectively. There were 69 deaths from cholera, but none recorded as due to either small-pox or plague.

Assam.—In Assam the number of births registered in 1903 was 187,669, or 7,194 more than in the preceding year, and the birth-rate was 35·57 per 1,000 against 34·21 in 1902. The highest district birth-rate was as usual registered in Goalpara, 43·22, followed by Sylhet and Darrang, where the birth-rates were 38·16 and 35·26, respectively; the lowest district birth-rates were 33·19 in Kamrup, 28·04 in Lakhimpur and 27·81 in Sibsagar. In rural areas the mean birth-rate was 35·73 per 1,000 as compared with 28·24 in the towns. By far the highest urban rate was 48·45 recorded in Barpeta where alone among Assam towns the female population is greater than the male population. The percentage of male to female births ranged from 111·97 in Sibsagar to 104·81 in Cachar, the mean being 106·72.

The number of deaths recorded was 140,069, or 13,001 fewer than in 1902, the death-rates of the two years being, respectively, 26·55 and 29·01. The highest district death-rate was 38·10, recorded in Darrang, where kala-azar was most prevalent and severe during the year. The next highest death-rates were 33·02 and 27·93 recorded in Gaolpara and Cachar, respectively, while the lowest rates were 22·73 recorded in Kamrup, 22·22 in Lakhimpur and 18·23 in Sibsagar. In rural areas the mean death-rate was 26·56 against 26·17 in the towns, among which the extreme rates were 38·57 in Golaghat and 16·09 in Silchar.

Muhammadans and Hindus died at the rates of 27·64 and 23·34 per 1,000, respectively, while Christians and "other classes" died at the rates of 14·41 and 44·24.

The death-rates among infants were 193·83 and 183·38 per 1,000 males and females born during the year. Boys and girls between the ages of one year and five years died at the rates of 31·51 and 30·54. The male death-rates were higher than those of females at all age periods, except 15-20, 20-30 and 30-40, the general mean being 26·71 among males and 26·38 among females.

Assam Tea Gardens.—The statistics relating to the tea gardens in Assam relate to the year ending the 30th June, 1904, during which the mean annual strength of the coolies employed rose from 644,045 to 654,021. Of this number 39·61 per cent. were employed in the Surma Valley and 60·39 per cent. in the Assam Valley, the distribution approximating closely to that of the preceding year. The birth-rate

was lower than during 1902-3; the recorded figures of that year, 30·8 per 1,000 of the total and 98·6 per 1,000 of the adult female population, having declined to 28·9 and 93·4 per 1,000, respectively, rates which compare unfavourably with the corresponding ratios of 35·37 and 125·0 for the province.

The death-rate fell from 25·4 to 24·0 per 1,000. Of the deaths, which totalled 15,742, malarial fevers caused the largest number (2,493), followed by dysentery (2,445), anchylostomiasis (1,985), respiratory diseases (1,884), diarrhœa (1,624) and cholera (738).

During the journey of the coolies to the Assam Valley, 16 deaths only occurred as compared with 57 in the previous year, 10 against 42 being due to cholera. No death occurred among coolies in transit to the Surma Valley or at the depôts of the Sylhet and Cachar districts.

United Provinces.—The number of births registered in the United Provinces in 1903 was 2,200,031 against 2,186,201 in the preceding year, and the birth-rate was 46·13 per 1,000 as compared with 45·84 in 1902 and a quinquennial mean of 42·60. In eleven districts, headed by Shahjehanpur 56·08, Hardoi 55·68, and Budaun 55·24, the birth-rates were above 50 per 1,000, and in only two, Naini Tal 31·36 and Dehra Dun 28·49, were they below 35. The mean birth-rate in towns was 42·88, the rates ranging from 64·73 in Pihani to 23·21 in Mirzapur-Bindhachal, 16·57 in Naini Tal and 12·87 in Mussoorie. The percentage of male to female births ranged from 113·24 in Ballia to 103·20 in Benares, the provincial mean being 107·59 against 107·25 in 1902.

The number of deaths recorded was 1,920,903 against 1,552,046 in 1902, and the death-rate was 40·28 as compared with 32·54 in 1902 and a quinquennial mean of 30·91. The highest district rates were 55·90 in Hamirpur, recorded mainly as fevers and other causes, and 54·14 and 52·11 in Lucknow and Cawnpore, both districts in which plague was severe. The mean rural death-rate was 39·16 against 54·86 in the towns, in many of which, including Cawnpore 89·47, Sahatwar 81·4, Sitapur 78·35, Nawabganj 75·01 and Fyzabad-Ajodhya 71·71, plague was severely epidemic. The second highest municipal death-rate was recorded in Hardwar, where a death-rate of 81·73 per 1,000 includes rates of 8·32 under cholera, 2·97 under plague, 48·91 under fevers and 5·90 under dysentery and diarrhœa.

The death-rate among Christians was 12·00, among Muhammadans 41·01, and among Hindus 39·85, the last rate being reduced artificially by the inclusion of the deaths of certain sects of Hindus among "other classes."

Owing to the prevalence of measles the death-rates of children were very high, 279·2 male and 269·1 female infants, respectively, having died among every thousand born, while boys and girls between the ages of one year and five years died at the rates of 89·71 and 88·49 per 1,000 living, according to the census figures. In the age periods 10-15, 15-20, 20-30 and 30-40 the female death-rates were higher than the male, the excess being most marked in the age period 15-20. The mean death-rates were among males 40·15, among females 40·41.

Punjab.—The number of births recorded in the Punjab fell from 880,477 in 1902 to 862,862 in 1903, the birth-rate in the latter year being 42·9 against 43·8 in 1902 and a quinquennial mean of 40·7. Among the districts the highest birth-rates were 50·1, 49·7 and 46·7 recorded, respectively, in Sialkot, Jhang and Mooltan; and the lowest 35·0, 34·5 and 17·3 in Kangra, Dera Ghazi Khan and Simla, respectively. The mean percentage of male to female births was 110·3, the percentages ranging in the districts from 121·8 in Dera Ghazi Khan to 104·6 in Delhi.

While the number of births recorded in 1903 was considerably less than in 1902, the number of deaths was much greater, the figure rising from 886,973 in the earlier to 985,476 in the later year. The death-rate in 1903 was 49·0 per 1,000 against 44·1 in 1902 and a quinquennial mean of 36·7. Among the districts the highest death-rates were 96·3 recorded in Gujranwala, where the plague death-rate was 63 per 1,000, 74·9 in Amritsar, where the plague and fever death-rates were, respectively, 25·6 and 32·2 per 1,000, and 66·1 in Jullundur, where the plague death-rate was 28·6; and the lowest, 26·6 in Montgomery, 26·3 in Dera Ghazi Khan and 24·5 in Simla. In rural areas the mean death-rate was 48·58 as compared with 52·89 in the towns, in some of which enormous rates due to deaths registered under the headings plague or fever were recorded. Muhammadans died at the rate of 49·36 per 1,000, and Hindus at the rate of 48·68; Christians died at the rate of 23·90, and "other classes,"

to whom the deaths of many persons placed under other headings at the census are credited, at the recorded rate of 64·57.

The death-rates of male and female infants estimated on the number of births recorded during the year were 260 and 270 per 1,000, respectively, the female death-rate being considerably the higher. Boys and girls over one year and under five years of age died at the rates of 72·48 and 80·17, respectively, and at all age-periods the female death-rates were the higher, the provincial means being 45·1 among males and 53·6 among females.

North-West Frontier Province.—The number of births registered in 1903 was 62,866, or 4,038 fewer than in 1902, and the birth-rate which was 33·6 in the earlier year fell to 31·6 in the later year, the rates in the district ranging from 56·2 in Dera Ismail Khan to 29·7 in Peshawar. The provincial mean percentage of male and female births rose from 121·9 in 1902 to 122·8 in 1903, ranging from 136·0 in Peshawar to 109·1 in Hazara.

The number of recorded deaths, which in 1902 was 48,624, increased by 7,915 to 56,539 in 1903, and the death-rate rose from 24·4 per 1,000 to 28·4, ranging in the districts from 35·8 in Dera Ismail Khan to 22·9 in Hazara. In rural areas the death-rate averaged 28·0 against 32·8 in the towns, in some of which high rates, mainly due to fevers, were recorded. Muhammadans died at the rate of 28·93 per 1,000, Hindus at the rate of 23·70 and Christians and "other classes" at the rates of 8·28 and 13·49, respectively. For every thousand births recorded of males there were recorded 202·9 deaths of male infants, the corresponding figure for females being 198·8. Boys and girls between one year and five years of age died at the rates of 56·60 and 58·05, respectively. At all age periods, except 50-60, the female death-rates were the higher, the mean total rates being 27·6 among males and 29·4 among females.

Central Provinces and Berar.—Consequent upon the union of Berar with the Central Provinces, the sanitary administration of the former was taken over by the Sanitary Commissioner of the Central Provinces on November 1st, 1903, and in future the statistics of the Provinces will be treated together. In 1903 there were 432,491 and 131,057 births recorded in the Central Provinces and Berar, respectively, the birth-rates being 44·27 and 48·16 against 48·29 and 56·9, respectively, in the preceding year. Calculating the total births recorded, 563,548, on the aggregate population of the two provinces, the birth-rate was 45·11 per 1,000 compared with a birth-rate similarly calculated for 1902 of 50·17. Among the districts the highest rates were 52·09 in Mandla, 51·39 in Wun and 50·38 in Wardha; and the lowest 39·80 in Raipur, 38·82 in Bhandara and 37·41 in Burhanpur, in which plague was particularly severe. The rural birth-rate was 44·90 as compared with 37·25 in the towns in the Central Provinces; the corresponding figures for Berar were 49·42 and 41·15, respectively. The percentage of male to female births was 104·97 in the province as a whole; in the Central Provinces it was 104·90, ranging from 108·91 in Damoh to 103·00 in Mandla; in Berar it was 105·22, ranging between 106·74 in Ellichpur to 103·96 in Wun.

The total number of deaths recorded was 443,697, including 330,104 in the Central Provinces and 113,593 in Berar. The total death-rate was 35·52 as compared with 27·33 in 1902; the death-rate of the Central Provinces being 33·79 per 1,000 against 25·82 in the preceding year; and that of Berar 41·74 against 32·80. Among the districts, the highest rates were recorded in Burhanpur, 65·31, including 21·95 from plague, Nagpur 58·33, including 20·34 from plague, and Narsingpur 55·34, including 8·15 from plague; the lowest in Balaghat (23·62), and Bhandara (22·66), in both of which plague was comparatively slight, and Sambalpur (20·02), from which plague was entirely absent. In rural areas the mean death-rate was 32·36 as compared with 64·59 in the towns. Among the latter excessively high rates were registered in Kamptee, 166·04, of which 108·11 was due to the occurrence of 4,202 deaths from plague; Amraoti, 129·35, of which 93·12 was due to plague; Nagpur, 115·90 (plague 75·17); and Murtizapur, 100·39 (plague 62·86). Muhammadans and "other classes" died at the rate of 52·69 and 52·47 per 1,000, respectively, and Hindus at the rate of 32·23.

Male infants died at the rate of 285·1 per 1,000 born, and females at the rate of 257·0. Boys and girls over one year and under five years died at the rates of 53·80 and 47·05, respectively. The female death-rates were very slightly higher than the male rates in the age periods 10-15 and 15-20, the mean rates at all ages being 37·18 among males and 33·89 among females.

Madras.—There were 1,165,080 births registered in Madras in 1903, the highest number yet recorded, equal to a birth-rate of 31·2 per 1,000 as compared with 28·2 in 1902 and a quinquennial mean of 28·8. The highest district birth-rates were 39·2 in Chingleput, 39·0 in Madras and 34·3 in both Tanjore and Tinnevelly; the lowest rates were 28·0 in Cuddapah, 24·8 in Ganjam and 23·3 in Madura. The mean birth-rate recorded in the rural areas was 31·2 against 31·4 in the towns. By far the highest urban rate was 87·6 recorded in Sermadevi, a town of about 13,500 inhabitants, in Tinnevelly, followed by rate of 50·2 in Vaniyambadi, and 48·4 in Kadayanallur. At the other end of the scale were Nellikuppam, a town of 13,137 inhabitants, in South Arcot, where the recorded birth-rate was 3 per 1,000, Vempalli (population 10,793) in Cuddapah, where the rate was 1·7, and Vetapalemu in Kistna, where the rate was 1·2. The percentage of male and female births ranged from 106·8 in Ganjam to 100·3 in Anantapur, the provisional mean being 103·6.

The recorded deaths numbered 826,663 or 94,226 more than in 1902, and the registered death-rate rose from 20·2 in that year to 22·2 in 1903, which is 1 per 1,000 more than the quinquennial mean. In the districts the rates ranged from 37·9 in Madras to 18·1 in Vizagapatan, 16·1 in Madura and 14·6 in Ganjam. In rural areas the mean death-rate was 21·5 as compared with 27·3 in the towns. Among the latter the enormous rate of 162·4 was registered in Vaniyambadi (population 12,005), where a death-rate from plague of 113·7 per 1,000 coincided with a birth-rate of over 50. The next highest death-rate was 56·3 recorded in Tiruppattura, where the plague death-rate was 33·0, and this was followed by a rate of 44·7 in Coonoor, including 14·2 ascribed to plague. In Rajampet, a town of over 15,000 inhabitants, in Cuddapah, the death-rate was reported to be 2·7, and in Vempalli and Vetapalemu, respectively, the recorded death-rates were 1·9 and ·5 per 1,000.

Muhammadans, Hindus and Christians died at the rates of 24·5, 22·3 and 19·4, respectively.

Male infants died at the rate of 186·7 and female infants at the rate of 168·2 per 1,000 born during the year, respectively; and boys and girls over one year and under five years of age died at the rates of 30·1 and 28·6. In the three age periods between 10 and 30, the female death-rates were the higher, the general rates for the sexes being 22·8 among males and 21·5 among females.

Coorg.—The number of births registered in Coorg was 4,787 or 468 more than in 1902, and the birth-rate rose from 23·91 in that year to 26·51 in 1903, ranging in the districts from 39·10 in Padinalknad to 18·70 in Yedenalknad. The percentage of male and female births was 104·31.

The total number of deaths rose from 4,887 in 1902 to 5,676 in 1903, and the death-rate from 27·06 to 31·43, ranging in the districts from 36·02 in Nanjarajapatna to 29·0 in Kiggatnad. In rural areas the mean death-rate was 29·82 against a town rate of 48·79. By far the highest town death-rate was 83·12 recorded in Virajendrapet, where the mortality from dysentery and diarrhœa was 16·58, from plague 6.30 and from "other causes" 32·92. The death-rate of Muhammadans was 36·99, those of Hindus and "other classes" 30·97 and 30·11, respectively. The death-rates of male and female infants were 253·7 and 198·5, respectively, per 1,000 born; and of boys and girls between the ages of one year and five years 40·83 and 32·93. In the age periods 15-20, 20-30 and 30-40 the female death-rates were the higher, the means at all ages being 30·78 and 32·23.

Bombay.—The births recorded in the presidency of Bombay during 1903 numbered only 576,949 as compared with 631,393 in 1902 and 664,305 in 1893. The birth-rate, which had risen from 25·19 per 1,000 in 1901 to 34·16 in 1902, fell to 31·22 in 1903. Among the districts the highest rates were registered in Ahmednagar 43·30, Khandesh 42·64 and Nasik 40·18, and the lowest in the City of Bombay 21·19, and in the Sind districts of Hyderabad 17·61, and Thar and Parkar 13·25. In rural areas the mean rate was 32·37 as compared with 23·56 in the towns. The percentage of male to female births in the presidency as a whole was 107·94, ranging in the districts of Bombay proper from 108·41 in Bombay City and 108·29 in Kaira to 101·15 in Bijapur, and in the districts of Sind from 138·24 in Hyderabad to 116·98 in Karachi.

The registered deaths numbered 811,525, the highest number on record except that recorded in 1900, when the deaths numbered 1,318,783. The death-rate in 1903, which includes a death-rate of 15·22 ascribed to plague, was 43·91, or 4·87 per

1,000 higher than in the preceding year. In the districts of Belgaum and Dharwar, where plague was most severe, the recorded death-rates were, respectively, 74·53 and 73·93 per 1,000; in the City of Bombay the death-rate was 65·99, and in the district of Sholapur 64·94. Of the six districts in Sind, where registration is most defective, some were free from plague, and in two of those, Thar and Parkar, 17·95, and Upper Sind Frontier, 15·19, the lowest death-rates were registered. In rural areas the mean death-rate was 41·51 against 18·36 in the towns, among which the mean plague death-rate was 23·89 as compared with 13·19 in rural areas. Among the towns by far the highest rates were recorded in Athni (138·83), a town of 11,107 inhabitants, in the Belgaum district, where 1,165 plague deaths were reported, and Ranebennur (123·90), a town of 14,851 inhabitants, in the Dharwar district, where the plague deaths numbered 1,379. In Ahmednagar the death-rate was 84·45, including rates of 42·23 recorded under plague and 15·54 under respiratory diseases. The lowest rates were 18·36 in Karwar and 14·20 in Vengurla, in each of which only one plague death was reported.

The death-rate of Hindus was 47·70, against rates of 30·65 among Muhammadans, 27·60 among Christians and 27·11 among Parsis.

The death-rate among male infants was 219·57 and among female infants 206·70 per 1,000 born, respectively; and boys and girls between the ages of one year and five years died at the rates of 53·29 and 51·26. In infancy, childhood, and from middle age onwards, the male death-rates were the higher, but in the age periods 5-10 to 30-40 inclusive, the female rates were the higher, the difference being most marked in the age period 10-15, when the death-rate of females was 6·71 higher than that of males. Throughout life the mean death-rate among males was 43.42 per 1,000 against 44·43 among females.

Lower Burma.—The number of births in Lower Burma in 1903 was 184,561, the highest number yet recorded. The birth-rate was 33·54 per 1,000 against 31·57 in the preceding year. The highest district birth-rate was 46·01 per 1,000, recorded in Thayetmyo, followed by 43·64 and 42·76 in Tharrawaddy and Henzada, respectively; and the lowest rates were 26·63 in Toungoo, 25·61 in Thaton and 17·95 in the urban district of Rangoon, where it is reported the closer supervision now being exercised by the health officer and his assistant is bringing about an improvement in registration. In rural areas the mean birth-rate was 34·52 as compared with 26·50 in the towns. In four towns the recorded birth-rate exceeded 40 per 1,000, namely, the little town of Zigon, where a birth-rate of 89·73 in 1902 was succeeded by a rate of 82.49 in 1903, Gyobingauk 42·79, Allanmyo 41·54, and Kawkareik 41·34. The percentage of male to female births averaged 108, ranging from 119 in Mergui to 101 in Henzada.

The number of deaths recorded was 132,767 or 15,381 more than in 1902, and the death-rate rose from 21·16 in that year to 24·13. Considerably the highest district death-rate was 34·57 recorded in the Rangoon town district, followed by rates of 30·83 and 30·45 in Thayetmyo and Pegu, respectively; the lowest district rates were 17·41 recorded in Tavoy, 16·44 in Thaton and 15·58 in Mergui. In rural areas the mean death-rate was 22·98 against 32·33 in the towns, in which the rates ranged from 66·57 in Zigon and 46·05 in Kyaiklat to 21·32 in Letpadan and 15·18 in Mergui.

Buddhists died at the rate of 24·64, Hindus at the rate of 23·44, Muhammadans and "other classes" at the rates of 20·63 and 20·57, respectively, and Christians at the rate of 16·80.

Male infants died at the rate 220·52, and female infants at the rate of 168·12 per 1,000 born; boys and girls over one year and under five years of age died at the rates of 29·16 and 25·37 per 1,000 living at those ages at the time the census was taken. At all age periods, except 30-40, the male death-rates were the higher, the mean death-rate among males being 25·55 and among females 22·52.

Upper Burma.—In twelve towns of Upper Burma with an aggregate population of 294,715, made up of 149,314 males and 145,401 females, both births and deaths are registered; in the province generally only deaths are registered. The mean birth-rate of the towns was 37·48, the rates in individual towns ranging from 55·17 in Kyaukse to 30·62 in Minbu. The mean recorded percentage of male to female births was 105, the percentages in the different towns showing extraordinary variation, the extremes of which were 123 in Salin and 73 in Kyaukse.

In Upper Burma the number of deaths recorded was 62,941, and the recorded death-rate was 21·80, ranging in the districts from 38·19 in Kyaukse to 12·02 in Meiktila. In rural areas the mean death-rate was 19·83 against 39·20 in the towns, in which the rates ranged from 64·58 in Kyaukse to 25·46 in Yamethin.

Christians died at the rate of 17·58, Muhammadans at the rate of 20·54, Buddhists at the rate of 21·81, and Hindus and "other classes" at the rates of 23·21 and 31·95, respectively. At all age periods, save 20-30 and 30-40, the male death-rates were the higher, the means being 22·59 per 1,000 among males, and 21·10 per 1,000 among females.

Ajmer-Merwara.—The number of births recorded in this small province during 1903 was 14,061, equal to a ratio of 29·48 per 1,000 of population, against a quinquennial mean of 27·67. The quinquennium includes the years 1900 and 1901, when the number of births fell below 8,000, and the year 1902 when the number rose to 17,207. The number of males born to every hundred females born was 117·66, while in 1902 and 1901 the percentages were 115·25 and 119·15, respectively.

The number of deaths registered in 1903 was 13,720, equal to a death-rate of 28·77 per 1,000. The mortality was lower than in either 1902 or 1901, when the deaths recorded numbered 15,672 and 15,798, yielding death-rates of 32·86 and 33·13, respectively. The quinquennial mean was 53·06, but includes the year 1900, when the death-rate recorded was 119·97 per 1,000. The death-rate in the districts was 24·20, and in the towns 41·01; the corresponding rates in 1902 were 29·88 and 40·85.

Hindus died at the rate of 29·66, and Muhammadans at the rate of 32·40 per 1,000, as compared with rates of 35·05 and 31·49, respectively, in the preceding year.

The recorded death-rates among male and female infants were almost identical, being 260·7 for males and 260·5 for females per 1,000 of registered births, which represents an increase on the rates of 219·15 for males and 214·41 for females in 1902.

As was the case in the preceding year, the male death-rates were the higher at all age periods, except 15-20, 20-30 and 30-40. The average death-rates of the sexes were 28·52 among males and 29·05 among females.

History of the Chief Diseases.

Mortality from different diseases.—The following table shows at a glance the number of deaths and the death-rates per 1,000 of population recorded in India from each of the chief diseases during 1903 and 1902. It will be seen that the mortality from many of the other diseases was, as usual, quite insignificant as compared with that recorded under the heading "fevers," and that in 1903, with the exception of small-pox, there was an increase under all headings.

Disease.	Number of deaths.	Number of deaths.	Death-rate per 1,000.	Death-rate per 1,000.
	1903.	1902.	1903.	1902.
Cholera	312,854	224,136	1·37	1·01
Small-pox	93,693	115,443	·41	·52
Plague	865,578	583,937	—	—
Fevers	4,459,237	4,279,551	19·66	19·17
Dysentery and diarrhœa	273,459	235,750	1·21	1·06

Cholera in India in 1903.—The number of deaths from cholera recorded in British territory during 1903 was 312,854, equal to a death-rate of 1·37 per 1,000 of the total population under registration. If the deaths recorded in the native States from which returns were received be added, the total amounts to 314,298. In the previous year 224,136 deaths from cholera were recorded in British territory, giving a ratio of 1·01 per 1,000 of population. The increase in mortality from this disease was shared by all the British provinces, except Assam, Madras, Bombay and Ajmer-Merwara. So far as can be gathered from a study of the reports of provincial Sanitary Commissioners, it appears that the increased prevalence of the disease is to be attributed partly, at any rate, to the fact that 1903 was the year when the great Kumbh Mela, which takes place once in twelve years, was held. The chief bathing day, which fell on the 13th of April, was attended by about 400,000 people, and all went well until the 16th, when some three-fourths of the people had dispersed and the general and sanitary arrangements were being broken up. It is said that on this day cholera broke out with great virulence among a sect of faquirs, and that from them it rapidly spread to other pilgrims still remaining in and about Hardwar, and it is reported that as these people dispersed to their homes, they carried the disease with them into other parts of the United Provinces, into the Punjab, the North-West Frontier Province and the Central Provinces. As regards the seasonal prevalence of cholera during 1903, the disease remained more or less in abeyance over the greater part of the country during the first three months of the year, and even until the end of April the total number of deaths was considerably less than had been recorded during the same period in 1902. From the beginning of May the prevalence of the disease increased rapidly to a maximum in July, and decreased equally rapidly during August, September and October, which was the month of least prevalence. In November and December a second but smaller rise in the mortality from cholera occurred. The greatest numbers of deaths from the disease were recorded during the year in Bengal, the United Provinces, the Madras Presidency and the Punjab; and the highest death-rates in Bengal, Assam, Upper Burma, the United Provinces, Lower Burma and the Punjab.

Deaths from Cholera in British Provinces, by months, during the year 1903.

PROVINCES.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	RATIO PER 1,000 OF POPULATION.	
														1903.	1902.
Bengal	13,456	9,183	13,618	21,770	23,033	25,367	37,286	25,963	8,642	4,414	7,784	12,884	203,405	2·73	2·02
Assam	733	208	188	705	1,512	1,401	982	560	517	399	649	506	8,360	1·58	2·40
United Provinces of Agra and Oudh.	55	130	168	1,028	3,769	8,461	16,899	6,536	3,985	3,466	2,048	614	47,159	·99	·53
Punjab	—	—	—	229	959	3,054	6,184	2,300	1,512	431	17	2	14,688	·73	·02
North-West Frontier Province.	—	—	—	3	43	305	469	214	283	28	—	9	1,354	·68	—
Central Provinces and Berar.	—	—	—	17	12	77	84	6	68	156	17	—	437	·03	·003
Madras Presidency ..	1,573	1,281	1,108	1,078	1,556	3,491	3,970	2,314	1,206	1,133	1,480	7,203	27,393	·7	·8
Coorg	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Bombay Presidency	2	2	2	—	191	413	338	407	239	212	12	7	1,825	·09	·17
Burma, Lower ..	430	400	400	732	919	422	421	399	199	327	438	259	5,346	·97	·33
„ Upper ..	—	—	1	12	114	295	862	542	268	255	331	207	2,887	1·00	·02
Ajmer-Merwara ..	—	—	—	—	—	—	—	—	—	—	—	—	—	—	·07
Total	16,249	11,204	15,485	25,574	32,113	42,286	67,495	39,241	16,919	10,821	12,776	21,691	312,854	1·37	1·01*

* Excluding Upper Burma—figures received late.

Cholera in Bengal.—In Bengal in 1903 the total number of deaths recorded as due to cholera was 203,405, or 2·73 per 1,000 of the population, as compared with 150,971 or 2·02 per 1,000 in 1902, and 110,753 or 1·48 per 1,000 in 1901. The mortality during 1903 was higher than in any of the previous six years, except 1900. No district was entirely free from the disease which attacked 27,309 villages against 22,642 in 1902, and assumed an epidemic form in 116 registering circles against 67 in that year. The district of Champaran in the Patna division suffered most severely and

lost 7·69 per 1,000 of its population from this cause. Other districts in which the mortality from cholera was very high were Puri in the Orissa division (6·31 per 1,000), Shahabad in the Patna division (6·12 per 1,000), 24-Parganas in the Presidency division (5·82 per 1,000), and Cuttack in the Orissa division (5·13 per 1,000). In Champaran the disease prevailed most severely in July and August, causing during this period 9,500 deaths in the district. In Shahabad the disease caused more than 10,600 deaths during the period from June to August. The Civil Surgeon of this district was of opinion that the epidemic was aided by the late commencement of the monsoon, the disease greatly diminishing when rain fell in sufficient quantity to flush and cleanse the sources of drinking-water supply. This was the experience of Civil Surgeons in other districts. In twenty-five districts during the cholera outbreaks tanks and wells were disinfected. In most cases a systematic record of results was not maintained, but the measure is generally said to be attended with beneficial results. In Puri, however, in spite of the wells having been disinfected before the commencement of the cholera season, the second highest death-rate from cholera among all the districts was recorded.

The highest death-rates from this disease recorded in towns were 18·71 per 1,000 in Motihari in the Champaran district, 14·07 in Faridpur, and 12·13 in Nadia, both in the Nadia district, and 11·74 in Raghunathpur in the Manbhum district. Among rural areas the highest death-rate (17·41 per 1,000) was recorded in Basudebpur in the Balasore district.

Among the European seamen of the port of Calcutta there were only 4 deaths from cholera, and there were 69 among the native floating population.

Cholera in Assam.—The number of deaths attributed to cholera in Assam during 1903 was 8,360, equal to a ratio of 1·58 per 1,000 of the census population. In the previous year the number of deaths from cholera recorded in this province was 12,658, giving a ratio of 2·40 per 1,000 of population. With the exception of Bengal the death-rate from cholera in Assam during 1903 was the highest among the provinces for the year, and the diminished mortality as compared with that of 1902 was confined almost exclusively to the districts of Cachar and Sylhet in the Surma Valley. Both these districts had suffered severely in 1902. In all the districts of the Brahmaputra Valley, except Kamrup and Lakhimpur, the death-rates from cholera were higher than in the previous year, and in the Darrang and Nowgong districts, both of which had been comparatively free from cholera during 1901 and 1902, the death-rates reached the high totals of 3·76 and 6·73 per 1,000 of population, respectively.

The death-rate from cholera among tea-garden coolies was less than that among the general population of Assam, but in certain districts, such as Kamrup, Sibsagar and Lakhimpur, where the general population suffered only slightly, the tea-garden coolies suffered severely. On the other hand, the tea-garden coolies in the Nowgong and Darrang districts, where the general population suffered so severely, enjoyed comparative immunity from the disease.

The death-rate from cholera among tea-garden cooly immigrants rose from ·9 per 1,000 in 1902 to 1·6 per 1,000 in 1903, but the ratio is a low one compared with that of most previous years of record.

Cholera in the United Provinces.—The total number of deaths from cholera recorded in the United Provinces during 1903 was 47,159, equal to a ratio of ·99 per 1,000 of population, as compared with a total of 25,160 and a ratio of ·53 during 1902. It is possible that in the ordinary course of events there would have been but little cholera in the United Provinces during 1903, for the total number of deaths recorded from this disease up to the end of March was less than half the number recorded during the same period in 1902. But in April the Kumbh Mela, which takes place once in twelve years, was held at Hardwar. Pilgrims began to arrive in the middle of March, and it is estimated that by the end of the month some 100,000 people were present. Many remained until the Dikhauti fair on April 13th, and it is estimated that between the 28th March and this date an average of 200,000 to 250,000 pilgrims were constantly present on the fair site and in the neighbouring towns of Kankhal and Jwalapur. During this period, however, only 11 cases of cholera are reported to have occurred. The great bathing day on the 13th April was attended by about 400,000 people. By the 16th April about three-fourths of these people had dispersed, and the general and sanitary arrangements were being broken up. It is reported that on this day cholera commenced with great virulence

among the Bairagis, a sect of faquirs, and that from them it spread to other pilgrims still remaining in and about Hardwar, who as they dispersed to their homes, are said to have carried it with them to other parts of the United Provinces. Over one-third of the total number of deaths from cholera in the United Provinces during 1903 occurred in July. During this month the temperature was considerably in excess of the normal, and the rainfall very scanty. In August, coincidently with a slight to considerable excess in the rainfall over the different divisions, the cholera mortality began to decline rapidly.

The highest district death-rates were recorded in Garhwal, Ballia, Dehra, Dun, Almora, Ghazipur and Rae Bareli, and the highest town mortalities were those of Bansdih (11·87 per 1,000), Ballia (8·38 per 1,000) and three other towns with ratios ranging from 8·32 to 7·00 per 1,000. In only 38 towns, as compared with 57 in 1902, no death from cholera was recorded.

In Ballia, the Dadri fair, at which it was estimated about 500,000 people were present, took place in November, but no case of cholera was reported to have occurred.

Cholera in the Punjab.—The Punjab had been almost free from cholera in 1901 and 1902, only 180 deaths from it being recorded in the former year and only 371 in the latter; but in 1903 cholera was present in epidemic form, and 14,688 deaths from this disease, equal to a ratio of ·73 per 1,000 of the population, were recorded. During the first three months of the year no death from cholera was reported in any part of the province, and it was not until after the Hardwar fair in the United Provinces in April that the epidemic in the Punjab began. It has already been mentioned that cholera broke out at this fair about the 16th of April, and it is said that immediately after the fair cases began to occur in different parts of the Punjab among pilgrims returning from Hardwar. There were 229 deaths registered from cholera in April in 15 districts, and in each district the first case was said to have been a pilgrim returning home from the Hardwar fair. During May 959 deaths from cholera were recorded, during June 3,054, and during July 6,184. In August the epidemic began to decline considerably, 2,300 deaths being recorded during that month, 1,512 during September, and 431 during October. The highest death-rates from the disease were recorded in the districts of Ludhiana (3·06 per 1,000), Ferozepore (3·01), Lahore (2·32) and Umballa (2·11). The highest death-rates recorded in towns were 16·51 per 1,000 in Sadhaura in the Umballa district, 12·22 in Sangla in the Gujranwala district, 8·17 in Kasur in the Lahore district, and 7·87 in Palwal in the Gurgaon district. In four other towns ratios of over 5 per 1,000 were recorded.

Cholera in the North-West Frontier Province.—In 1903 in the North-West Frontier Province 1,354 deaths from cholera, equal to a ratio of ·68 per 1,000 of the population, were recorded. In the previous year no death from cholera had been returned, and the epidemic which prevailed during the year under review is said to have been traceable to the importation of cases from Hardwar in the United Provinces, either directly or viâ Rawalpindi. The first death from cholera reported in the North-West Frontier Province is said to have occurred in Peshawar on the 21st of April. By the 24th of April, 59 villages in the Peshawar district were affected. Early in May the disease invaded the Kohat district, in June it spread to Bannu and at the end of that month the Hazara district was also affected. The district of Dera Ismail Khan was free from the disease. In the Kohat district 2·16 per 1,000 of the population were reported to have died from cholera, in the Bannu district ·71, in the Peshawar district ·60, and in the Hazara district ·54.

Cholera in the Central Provinces and Berar.—In the Central Provinces and Berar the total number of deaths recorded as due to cholera in 1903 was 437, or ·03 per 1,000 of the population, as compared with a total of 44 and a ratio of ·003 in 1902. Of the total number of deaths 363 were recorded in the Central Provinces and 74 in Berar. A small outbreak causing 31 deaths in three months commenced in the Bilaspur district of the Central Provinces in April, and a more important one prevailed in the Murwara district of the Vindhyan division during June and July. In this outbreak the disease was said to have been probably introduced from the United Provinces by lime-quarry workers.

The only outbreak in Berar commenced in the Wun district in August. It caused three deaths in that month, 21 in September, 49 in October, and one in

November. An outbreak which caused 115 deaths in the Chanda district of the Central Provinces was said to have originated from this epidemic in the Wun district of Berar.

Cholera in the Madras Presidency.—In the Madras Presidency there were 27,393 deaths recorded as due to cholera in 1903, giving a ratio of ·7 per 1,000 of population, as compared with a total of 29,769 and a ratio of ·8 per 1,000 in 1902. The districts of Anantapur, Kurnool, and the Nilgiris were the only ones in which no death from cholera was recorded. The highest death-rates in districts were 2·2 per 1,000 of population in Malabar, 2·1 in Trichinopoly, 1·8 in Salem, 1·7 in Tanjore and 1·6 in Madura. In Malabar 6,157 deaths from cholera were recorded and in Madura 4,422. The highest death-rates recorded in towns were 10·4 per 1,000 in Devakkottai and 9·8 in Ramnad, both in the Madura district, 9·8 in Salem in the Salem district, and 9·6 in Ponnani in the Malabar district. The death-rate recorded in the town circles of the Presidency was ·9 per 1,000, and in the rural districts ·7 per 1,000.

Cholera in Coorg.—No death from cholera was recorded in this small province during 1903. There had been no cholera in Coorg during 1902, but in 1901 the disease caused 58 deaths.

Cholera in the Bombay Presidency.—As in 1902 there was again comparatively little cholera in the Bombay Presidency during 1903. Only 1,825 deaths from this disease were recorded during 1903 as compared with 3,230 in 1902, the death-rates per 1,000 of population being respectively ·09 and ·17. Although a few deaths from cholera were recorded in nine other districts, the disease prevailed in epidemic form in only four districts of the Sind Province, in which districts 1,752 deaths from cholera occurred. During the first four months of the year the disease was absent from the whole Presidency, excepting Bombay city (5 deaths) and the town of Broach (1 death). In May, however, an epidemic commenced in the Sukkur, Larkhana and Upper Sind Frontier districts of Sind. The first case in this outbreak was reported from Thul (old) in the Jacobabad district as having been imported from Hardwar, and another case, imported from the same place, was reported in Shikarpur town on the 3rd of May. Indigenous cases and deaths then began to occur in this town. Sukkur was next attacked and then Rohri; afterwards the disease gradually spread into the rural circles of the Sukkur, Larkhana and other districts. Fortunately, the disease remained very localised, and throughout the whole Presidency only 160 villages were attacked during the year. Of these no less than 152 or 95 per cent. were in Sind. There was no cholera in any of the seven cantonments in the Presidency.

Cholera in Burma.—In Lower Burma during 1903 there were recorded as due to cholera 5,346 deaths, equal to a ratio of ·97 per 1,000 of population, as compared with 1,844 or ·33 per 1,000 from the same cause in 1902. The greatest numbers of deaths were recorded during April and May, and the fewest during September, December and October. The highest death-rates recorded in districts were 3.07 per 1,000 in Akyab, 1·80 in Amherst and 1·44 in Thongwa; in towns the highest death-rates were 10·78 in Nyaunglebin, 10·12 in Maubin and 7·97 in Kyaiklat. The total number of persons reported to have been attacked with cholera was 8,532, with a case mortality of 63 per cent.

In Upper Burma the total number of deaths recorded as due to cholera during 1903 was 2,887, as compared with only 57 during 1902. The disease prevailed in every district, but the Pakokku and Minbu districts suffered most severely. The death-rates from the disease in these districts were 2·36 and 2·05 per 1,000, respectively. The highest death-rates recorded in towns were 7·09 per 1,000 in Minbu, 6·94 in Myingyan, and 6·23 in Shwebo.

Cholera in Ajmer-Merwara.—No death from cholera was recorded in this province during 1903. The numbers of deaths reported under this heading in 1902 and 1901, respectively, were 32 and 50.

Anti-cholera inoculation.—The total number of inoculations performed at the Purulia depôt in Bengal during the year was 1,904, as compared with 3,144 in 1902 and 3,453 in 1901. In addition 298 operations were performed during the month of

December at the recently opened inoculation depôt at Asansol. The subjects were all cooly emigrants proceeding to the tea districts of Assam. Out of 2,633 uninoculated coolies proceeding by the steamers, plying between Goalundo and Dibrugarh, 68 or 2·58 per cent. were said to have been attacked with cholera, 16 of the cases proving fatal; while out of the 199 inoculated coolies who were on board these steamers 4 or 2·01 per cent. were reported to have been attacked by the disease, one of the cases ending fatally.

SMALL-POX.

The death-ratio per 1,000 of population from small-pox fell from ·52 in 1902 to 41 in 1903. The total number of deaths recorded during 1903 was 93,693, as compared with 115,443 in 1902 and 89,378 in 1901.

Table showing the Deaths from Small-pox registered in British Provinces, by months, during the year 1903.

PROVINCES.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL. 1903.	RATIO OF DEATHS PER 1,000 OF POPULATION 1903.
Bengal	2,429	2,746	4,216	4,514	4,453	4,649	2,754	1,578	775	511	575	1,259	30,459	0·40
Assam	245	126	146	162	130	118	62	23	11	24	17	47	1,111	0·21
United Provinces	917	1,158	2,205	3,721	4,225	4,166	3,083	1,316	482	224	133	320	21,950	0·46
Punjab	1,414	1,303	1,631	1,653	2,151	2,141	1,575	868	559	376	667	1,297	15,635	0·78
North-West Frontier Province.	246	259	251	234	300	223	218	234	134	136	202	257	2,694	1·35
Central Provinces	134	215	229	290	234	342	225	189	100	60	50	62	2,130	0·17
Lower Burma	87	141	178	282	176	119	105	39	26	15	66	22	1,266	0·23
Upper „	27	65	81	166	89	108	21	4	11	30	3	49	654	0·23
Madras Presidency	1,405	1 482	1,542	1,319	1,193	1,190	1,368	1.337	1,144	1,058	988	991	15,015	0·4
Bombay „	276	375	477	509	402	199	142	89	49	22	65	127	2,732	0·15
Ajmer-Merwara	--	--	—	—	—	4	—	—	—	—	—	—	4	0·01
Coorg	--	2	3	1	1	9	10	3	1	1	3	9	43	0·24
TOTAL	7,180	7.872	10,959	12,861	13,354	13,268	9,563	5,680	3,292	2,457	2,767	4,440	93,693	0·41

In Bengal the number of deaths from small-pox, which had been steadily increasing year by year since 1899, fell during 1903 to 30,459, as compared with 57,430 in 1902. In Assam the death-rate from small-pox during 1903 was ·21 per 1,000 of population as compared with 1·26 per 1,000 in 1902, but the diminished prevalence of the disease was chiefly confined to the Surma Valley districts, which had suffered so severely from small-pox in the previous year. The mortality in the districts of Darrang, Nowgong, and Sibsagar in the Brahmaputra Valley was higher than in 1902, but in no district was there a marked epidemic. The practice of inoculation is still carried on in some districts, and it is said that many of the inhabitants of the Nowgong district not only disbelieve in the protective efficacy of vaccination, but suspect it of producing small-pox. In the United Provinces 21,950 deaths from small-pox were recorded during 1903 as compared with 4,976 in 1902. The ratio (·46 per 1,000 of population) is the third highest among the provinces for the year. The highest death-rate recorded in districts was 3·46 per 1,000 in Rae Bareli, and the highest in towns 6·22 in Mau (Azamgarh). In the Punjab 15,635 deaths from small-pox, equal to a ratio of ·78 per 1,000 of population, were recorded during 1903 as compared with a total of 11,629 and a ratio of ·58 in 1902. The district of Rawalpindi, in which 2,614 deaths were recorded, was most severely affected, and the best-vaccinated district (Kangra) had, as usual, the lowest death-rate. The death-rate in municipal towns was higher than in rural circles. In the North-West Frontier Province the death-rate from small-pox in 1903 was 1·35 per 1,000 of population as compared with ·54 in 1902. The total number of deaths recorded from the disease was 2,694, and of this number no less than 2,500 were children under 10 years of age. The Vaccination Act is in force in only two towns, in both of which the ratio of mortality from small-pox was low. In both the Central

Provinces and Berar the recorded mortality from small-pox was considerably less during 1903 than in the previous year, but the provincial Sanitary Commissioner says that the district reports show that a number of deaths which were attributed to measles and chicken-pox were probably due to small-pox. In Berar only 104 deaths from small-pox were recorded, but no less than 571 from measles and chicken-pox. In the Madras Presidency 15,015 deaths from small-pox were recorded during 1903, a considerable decrease as compared with the previous year. A scheme for the reorganisation of the vaccination department and for compulsory vaccination in rural tracts has been submitted to the local Government. In the Bombay Presidency the number of deaths recorded as due to small-pox during 1903 was slightly greater than during 1902. Of the total of 2,732 recorded deaths 1,460 occurred in the city of Bombay. In Lower Burma the recorded number of deaths from small-pox fell from 1,565 in 1902 to 1,266 in 1903, but in Upper Burma the mortality from this disease increased.

Plague.

Since the commencement of the present epidemic of plague in India, in 1896, the disease has been steadily gaining ground year by year. In 1898, the first year in which the mortality from plague was shown in a separate table in this report, 89,265 deaths from the disease were recorded. In the following year the number of recorded deaths reached the total of 102,369. In 1900 the recorded deaths decreased to 73,576, but in 1901 the number, viz., 236,433, far exceeded the combined totals of the two previous years. A further increase to a total of 452,865 deaths was recorded in 1902, but even this figure is small compared to that of 1903, when no less than 684,445 deaths from plague were returned. As compared with other causes of death in 1903 the mortality from plague was more than twice as great as that from cholera, two and a half times as great as that from dysentery and diarrhœa, and more than seven times as great as that from small-pox. The total number of deaths recorded under the heading "plague" was about one-seventh of the total number recorded under the heading "fevers." As in the three preceding years the month of highest mortality during 1903 was March. The year 1903 is the third since 1898 in which the month of minimum mortality from the disease has been July; in each of the other years, except 1900 and 1902, it was June. As would be expected, however, the months of maximum and minimum prevalence of plague vary in different parts of India. During 1903 all the provinces of India were more or less affected except Burma, where only 9 deaths from plague (all being imported cases) were recorded, and Baluchistan, where only 3 deaths were recorded.

In this place it is usual to give a statement of the more recent researches upon plague. To a great extent such a statement is but a record of contradictory results obtained by different observers, and from time to time it is necessary to attempt to select the wheat from the chaff and to summarize such facts as appear to be undisputed, lest, amidst a mass of conflicting evidence, we forget the fundamental principles upon which sound prophylaxis can be based.

The bacillus.—In the first place all observers are agreed that plague is caused by the *b. pestis*, and that it is a disease which simultaneously attacks men and certain of the lower animals, especially the rat. Until lately no varieties of the true *b. pestis* were admitted, but Klein has recently suggested the possibility of there being at least two types of the bacillus, viz., (1) a virulent type bred in the human subject, which on gelatine exhibits raised colonies with filmy irregular margins, the bacilli being cylindrical in shape when taken from recent cultures, and (2) a less virulent type bred in the rat, exhibiting rounded translucent colonies on gelatine with coccus-like forms on culture. The rat is susceptible to both these varieties, but it is possible that only such human beings as are highly susceptible can be infected with the less virulent type. Dr. William Hunter, the Government bacteriologist of Hong Kong, is evidently of the same opinion as Dr. Klein upon this matter. He considers that rats suffer from two forms of plague an acute and a chronic; the acute form is produced by the ordinary virulent bacillus met with in man, and the chronic by a strain of the same bacillus which, by continued passage through rats, has become avirulent. The existence of these two varieties of the plague bacillus is important, for it enables us to explain certain questions in the epidemiology of plague which before were not clear.

Length of life of the bacillus in nature.—In the second place it is essential to come to a definite conclusion regarding the limits of life of the bacillus outside the bodies of human beings or of animals. Upon this point there is considerable difference of opinion. Observers have kept pure cultures of the bacillus alive for months or even years by protecting them from light, from drying and from heat, but such experiments afford no index of the length of life of the bacillus under the conditions it meets with in nature. Under such conditions the presence of saprophytic organisms, the action of heat, of drying, &c., are known to be very harmful to it, and no one has so far succeeded in finding plague bacilli in the air, in dust, or even in the earth unless it has been very recently contaminated with sputum or other material infected with the bacilli. The latest experiments upon the vitality of the bacillus in soil and in buildings are those made by Mr. Watkins-Pitchford, F.R.C.V.S., the Government bacteriologist of Natal. He found that in soil, the bacillus died out in five weeks and in buildings containing stores of grain and other produce in from four to eight weeks. If we may assume that the life of the bacillus as a saprophyte is thus limited, it would appear that for the maintenance of the disease between epidemic outbreaks infected human beings and animals are the chief factors at work.

Mode of spread of the disease.—This brings us naturally to the mode of spread of the disease. Even during the oldest recorded epidemics of plague a connexion between human plague and rat plague was recognised, but the nature of the connexion is a matter upon which opinions are still divided. Statements are made that epidemic human plague may exist in the absence of rat plague, that human plague may exist for some time previous to the appearance of the disease among rats, and that rat plague does not in every case lead up to an epidemic among men. It was with the intention of attempting to arrive at a solution of the problem regarding the exact connexion between human plague and rat plague that Dr. W. Hunter commenced in 1902 a systematic research into epidemic and epizootic plague in Hong Kong. During that year 117,839 rats were bacteriologically examined and during 1903, 101,056 rats. In 1902, 2,015 of the rats examined were found to be plague-infected, and in 1903 the number infected was 3,744. Charts were prepared showing side by side the number of cases of plague occurring each week among human beings and the number of plague-infected rats found. Separate charts were made for each district and another for the whole of Hong Kong. Considering these charts for the two years the following conclusions seem justifiable: (1) the curves of rat plague and of human plague are remarkably similar; (2) at a definite period each year the rat plague curve rises rapidly and is followed at an interval of about a fortnight by a similar rise in the human plague curve; (3) the point of maximum intensity of human plague is about a fortnight later than that of rat plague; (4) the rat plague curve declines and is followed by a similar fall in the human plague curve; (5) the human epidemic becomes extinct, but the rat epidemic does not; it remains in abeyance for a week or two and then recrudesces and remains at a low but more or less constant level until the following year, when its curve again suddenly shoots upwards to be followed within a very short time by the yearly epidemic in men; (6) rat plague is, therefore, epizootic continuously but human plague is only epidemic during the acute exacerbations of the epizootic.

If Dr. Hunter is correct, it appears to follow that epidemics of human plague in Hong Kong are directly dependant upon previous epizootics among rats. The fifth and sixth conclusions are very important for they serve to explain the bridging over of epidemics from one year to another. It has already been mentioned that rats suffer from two forms of plague, an acute and a chronic, and that the latter is caused by an avirulent type of the bacillus. Dr. Hunter has found that it is the chronic form of the disease which is present in rats during the intervals between human epidemics, the latter being present only during the prevalence of acute rat plague caused by the ordinary virulent variety of the bacillus. He considers that the yearly recrudescence of acute rat plague is occasioned by the infection of fresh generations of rats which are highly susceptible to plague infection, and that the recrudescence of acute rat plague, and, therefore, of the human epidemic, occurs at the period of the year when rats are most prolific.

In connexion with the spread of plague by other animals than rodents it will be remembered that in 1902 Professor Simpson stated, as a result of his investigations in Hong Kong, that "the experiments undertaken demonstrate that pigs,

calves, buffaloes, sheep, hens, ducks, geese, turkeys, and pigeons are, in addition to rats, susceptible to plague, and particularly so when fed with plague material." The great importance attaching to this announcement has led several observers to repeat Professor Simpson's experiments, and the result has been to show either that Professor Simpson was mistaken in the diagnosis of the disease from which the animals used in his experiments died, or that the susceptibility of animals in Hong Kong to plague is very different from that of animals in other countries. A careful research in connexion with this subject has lately been carried out by Major Bannerman, I.M.S., at the Plague Research Laboratory in Bombay, and another by Mr. Watkins-Pitchford, F.R.C.V.S., in Natal. In the Bombay experiments 4 pigs, 4 turkeys, 2 calves, 4 geese, 4 fowls, and 4 ducks were used and the methods prescribed by Professor Simpson were followed as exactly as possible. The experiments were carried out by "cutaneous inoculation," by feeding, and by subcutaneous injection, and in every case the results were entirely negative, thus confirming the experiments previously carried out in Bombay by the German Plague Commission. Mr. Watkins-Pitchford reports that in Natal repeated endeavours were made to induce a fatal form of plague by the ingestion of infected materials and by the inoculation of virulent cultures and blood, as well as by close contact with an animal in a highly infectious condition. None of the 20 hens, 10 pigs, and 2 calves used in these experiments contracted plague. It appears then that domestic animals in India and Natal are not liable to contract plague by ingestion, scarification, or subcutaneous injection.

Mode of Infection.—Assuming that Dr. Hunter's conclusions regarding the connexion between rat plague and human plague are correct, it becomes necessary to attempt to explain how rat plague is usually communicated to man. The avenues of infection in plague considered to be important are, the skin, the alimentary tract and the respiratory tract. Regarding the respiratory tract but little need be said, for most, if not all, observers are agreed that it is chiefly of importance in connexion with cases of primary pneumonic plague which are caused by the direct conveyance of bacilli from one person to another by means of microscopic particles of sputum scattered about during the acts of coughing, sneezing, or even speaking. As regards the skin, Albrecht and Ghon made the important observation, which has been amply confirmed, that plague bacilli, when rubbed into the shaved skin of a rat or guinea pig, always occasion a lethal infection. It is probable that a slight abrasion of the skin is a favouring circumstance in this mode of producing the disease, and in performing "cutaneous inoculation" with animals Klein makes a practice of scraping off the superficial epidermis and of slightly scarifying the exposed surface before rubbing in the contaminated material. He is evidently of opinion that the skin is the usual avenue of infection in plague. Hunter, on the other hand, while not denying that cases are frequently met with in which plague infection has occurred through an abrasion of the skin, says that the evidence at his disposal is decidedly against the conclusion that the skin is the common portal through which the plague bacillus gains an entrance into the bodies of men or animals. Influenced, doubtless, by the results reported by Professor Simpson referred to above, he considers the alimentary canal to be perhaps the most important point of entry of the bacillus into the body. Some of the grounds upon which he founds this conclusion are the following: (1) The symptoms complained of by plague patients in the earliest stages of the disease are often referable to the gastro-intestinal tract; (2) the condition found in the gastro-intestinal tract on post mortem examination is strongly suggestive of alimentary incorporation of the bacillus; (3) the bacillus is present very abundantly in the fæces of men and animals suffering from plague; (4) the bacillus is little if at all affected by the gastric juice; (5) experimental evidence in animals yields constant positive results. Pigs, fowls, sheep, monkeys, &c., if fed on plague-infected material, contract the disease with certainty; (6) in the rate the usual mode of infection is by the mouth; (7) food and articles of diet have been found infected with plague bacilli; (8) vermin such as flies, cockroaches, ants, &c., may harbour plague bacilli and convey the virus to food used by men or animals. Several of these reasons could be used equally well for an argument in favour of infection by the skin, and some of them are directly contradictory to the experience of other workers. The negative results obtained by Albrecht and Ghon in feeding experiments upon pigs and other animals were referred to in last report, we have seen that feeding experiments failed in Bombay and Natal, and Klein has lately published an account of some experiments on rats which point to infection

by the alimentary canal being of very rare occurrence in these animals. He points out that the readiest means of giving plague to a rat is by cutaneous inoculation or by subcutaneous injection, that amongst half grown and adult sewer rats an animal without any wound or abrasion is rather rare, that plague bacilli are present in the fæces and urine and are therefore distributed over any article with which the dejecta come in contact and that in this way it is easy to understand how the rat (with its frequent cutaneous wounds) becomes infected. He also points out that by whatever way, subcutaneously or cutaneously, a rat is infected, the abdominal viscera always participate in the disease, so that the presence of lesions in the intestines and mesenteric glands cannot be regarded as having been due exclusively to infection by food. In addition, out of 20 rats fed with the viscera of guinea pigs and rats dead of typical plague, only one died of plague, and even in this instance it was not improbable that the lungs had been the site of entrance of the virus.

The evidence is so conflicting that it is impossible at present to arrive at a definite conclusion as to the usual avenue of infection in plague, and it may well be that this will vary with the circumstances. In connexion with infection by way of the skin, it is, perhaps, no over-statement of the trend of present opinion to say that infection by the bites of fleas, bugs and other suctorial insects is now regarded by the majority of observers as far less probable than at the time of Simond's original suggestion. The opinions of Galli Valerio, Kolle, Nuttall, and Dieudonné on this subject were referred to in last report. Simpson and Hunter have also endeavoured to procure the infection of healthy rats and monkeys by plague-infected rat fleas with entirely negative results. Klein has also failed to produce infection in healthy rats by this method. In connexion with infection by way of the alimentary canal, Hunter attributes an important *rôle* in the spread of plague to flies and especially to cockroaches. During the epidemic of plague in Hong Kong in 1903 he examined a large number of flies, and on the bodies of at least 75 per cent. of those examined plague bacilli were found. On cockroaches also he found plague bacilli. There seems no reason to doubt that whether we regard the usual avenue of infection in plague to be the alimentary canal or the skin, the danger of the spread of plague bacilli by non-suctorial insects is very great.

Conclusions as regards prophylaxis.—It is not possible, for the reasons given above, to state definitely the exact mode by which rat plague is communicated to human beings, but if we accept the conclusion that the annual recrudescence of human plague epidemics is directly dependent upon a previous epizootic among rats, it is a secondary matter from the point of view of prophylaxis, by what mode the bacillus of rat plague gains entrance into the human body; whatever the exact mode of transference there can be no doubt of the importance of measures directed against rats, for whatever is effected by other measures, the yearly epizootic rat plague will still recur, to be followed inevitably by epidemic human plague. Whether Dr. Hunter's conclusions are correct or not they certainly point the way in which research might profitably be carried out in India. The seasonal prevalence of plague in this country is as definite as in Hong Kong, and it should not be difficult to show whether the bridging over of epidemics is dependent upon chronic infection in rats, whether the commencement of the yearly epidemic occurs at the season when fresh generations of rats appear, as is reported to be the case in Egypt, and whether the human epidemic follows an acute exacerbation of the epizootic among rats. If such should be shown to be the case an energetic campaign against rats carried out during the interval between the human epidemics might possibly meet with success. This is a measure which, it need scarcely be said, has been carefully considered by the authorities, but the very obvious difficulties, arising chiefly from the prejudices and apathy of the people in a matter which demands their willing co-operation, have hitherto been deemed to render the possibility of an effective campaign against these vermin more than doubtful, if not dangerous. In sanitary measures which affect intimately the domestic institutions and religious prejudices of the people of this country the authorities are frequently compelled to defer the scientific ideal to considerations which would not apply elsewhere. The sustained experience which the people have now suffered of the prevalence of the disease has gone far to foster the growth of the necessary confidence in the measures directed by Government for their relief, and their co-operation and sympathy may now perhaps be relied on more confidently, if the areas for an experimental effort, in the first instance, be judiciously selected, and the necessary measures be carefully planned.

Table showing the deaths from Plague Registered in British Provinces by Months during the year 1903.

Province or State.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total. 1903.	Total. 1902.
Bengal	9,763	12,808	20,975	11,983	1,272	182	114	105	281	612	2,232	5,353	65,680	32,967
Assam	—	—	—	—	13	14	1	—	—	—	—	—	28	—
United Provinces of Agra and Oudh.	10,214	12,148	19,222	15,828	3,960	291	6	21	254	1,796	6,542	10,447	80,729 *	43,487 (a)
Punjab...	8,906	16,435	36,789	62,907	40,426	14,270	163	65	151	1,961	4,267	5,728	192,068 †	175,645 (a)
North-West Frontier Province.	—	—	—	3	—	—	—	—	1	11	34	—	49	4
Punjab Native States (Kapurthala, Patiala Nabha, Kalsia, Malerkotla, Bhawalpur, Jhind, Nalagarh, Baghat, &c.).	898	1,131	3,530	7,312	4,033	721	53	—	20	92	417	422	18,629	46,890
Jammu and Kashmir State.	—	5	77	254	354	87	4	—	24	68	110	70	1,053	5,690
Central Provinces ...	4,310	8,175	8,809	3,234	328	7	2	672	3,762	5,421	8,734	8,060	51,514	4,647
Burma	—	1	3	4	—	—	—	—	—	—	—	1	‡9	—
Madras Presidency ...	3,089	2,554	1,311	247	75	106	391	480	577	921	1,151	2,104	13,006	11,362
Madras Native States						No returns.								
Bombay	38,310	38,476	32,188	17,571	3,931	3,268	8,033	17,454	30,489	37,819	29,179	24,451	281,269	184,752
Bombay Presidency Native States.	7,146	9,045	8,605	4,255	1,443	736	1,895	5,601	8,946	13,208	12,800	8,803	82,483	38,590
Baluchistan	—	—	—	1	1	—	—	—	—	—	1	—	‡3	30
Ajmer-Merwara ...	—	—	1	—	—	—	—	6	24	12	5	—	48	1
Rajputana (Marwar State, Jaipur State, Sirohi State, Meywar, Ulwar, Bikaner).	10	84	775	404	44	5	—	2	108	141	317	552	2,442	149
Central India	239	1,471	2,198	1,454	184	4	82	1,652	5,343	5,919	4,219	3,404	26,169	408
Coorg	—	—	—	—	2	16	8	4	10	2	1	2	45	—
Mysore	3,428	2,076	920	321	164	348	1,063	1,880	2,322	3,106	2,229	2,366	20,223	26,301
Bangalore Civil and Military Station.	260	95	64	16	13	10	20	55	85	265	529	625	2,037	4,080
Hyderabad State ...	2,433	4,744	2,662	909	683	3	106	1,377	4,158	3,722	3,241	4,056	28,094	8,934
Total ...	89,006	109,248	138,129	126,703	56,926	20,068	11,941	29,374	56,555	75,076	76,008	76,444	865,578	583,937
Calcutta City	245	1,058	3,526	2,596	320	74	52	55	76	71	81	68	8,222	7,883
Bombay „	1,693	3,486	5,858	5,721	1,580	657	347	335	322	262	220	270	20,751	18,694
Madras „	1	1	—	—	—	—	—	—	—	1	—	3	6	3

(*a*) These figures do not agree with those given by Provincial Sanitary Commissioners in their annual reports.
* 84,499 in Statement No. VI. of the Provincial Sanitary Report.
† 205,462 in Statement No. VI. of the Provincial Sanitary Report.
‡‡All imported cases.

Plague in Bengal.—The mortality recorded from plague in Bengal during 1903 was nearly twice as great as during the previous year, the total number of deaths recorded as due to this disease being 65,680, or a ratio of ·88 per 1,000 of population, as compared with a total of 32,967 and a ratio of ·44 in 1902. The highest death-rates recorded in districts were 10·61 in Saran, 9·69 in Calcutta, 7·19 in Patna and 3·87 in Shahabad. The disease was present in 29 districts in 1903 as compared with 24 in 1902, and in most districts where the disease occurred during both years the death-rates were higher in the former than in the latter year. The monthly mortality from the disease showed the same peculiarity as regards rise and fall as had been noticed in previous years, viz., a rise to the maximum in March, a steady fall month by month to the minimum in August, and a recrudescence in September and subsequent months to the end of the year.

It appears that throughout the district of Saran the people practised evacuation of villages very largely, but it is said that their general attitude towards the disease was one of marked apathy. Inoculation met with little success in this district, but disinfection was in many cases asked for. In Patna, on the other hand, chemical disinfection was said to be unpopular, though desiccation by burning cowdung cakes on the floors was said to have been understood by all and to have been carried out by many.

Plague in Assam.—Assam, which had remained free from plague until 1903, experienced a small epidemic causing 37 cases with 28 deaths in that year. The first cases were detected about the 16th of May in Dibrugarh. It had been noticed for a few days that rats were dying in great numbers, and as the first and most of the other cases occurred in the foreign grain bazaar, in which neighbourhood the dead rats were also found, the first measures taken were based on the supposition that the outbreak was due to the importation of infected grain or rats. The measures were successful, and the last death occurred on the 3rd of July. The disease did not appear in any other part of Assam during the year.

Plague in the United Provinces.—In the United Provinces there was again a great increase in the mortality from plague, 84,499 deaths being recorded from this cause during 1903 as compared with 43,487 during 1902 and 9,778 during 1901. Deaths from plague were reported from 38 districts in 1903 as compared with 34 districts in 1902. The highest death-rates recorded in districts were 11·10 per 1,000 in Cawnpore, 9·07 per 1,000 in Allahabad, 6·69 in Lucknow, and 6·19 in Ballia; and the highest in towns were 35·33 in Sahatwar in the district of Ballia, 29·91 in Cawnpore and 29·44 in Fyzabad-Ajodhya. As in the previous year most deaths from plague were recorded in March and fewest in July. In the spring of 1903 the control of plague measures was placed under the Inspector-General of Civil Hospitals, assisted by a chief plague officer, as part of the general medical administration of the provinces.

Plague in the Punjab.—The total number of deaths from plague recorded in the British districts of the Punjab in 1903 was 192,068 as compared with 175,645 in 1902. In native states 18,629 deaths from plague were reported. The epidemic prevailed from the commencement of the year in 14 districts, and seven more districts became infected later in the year. The largest numbers of deaths in districts were 44,267 in Gujranwala, 25,355 in Amritsar, 24,664 in Lahore, and 23,826 in Jullundur. The disease attained its maximum intensity in April and was at its minimum in August. By a resolution of the Punjab Government important changes were introduced in the measures for dealing with plague and in the administration and control of plague operations. As regards the measures for dealing with plague, the element of compulsion has been almost entirely eliminated, and while the local Government has recognised and provided for the obligation of rendering assistance to the inhabitants of plague-stricken towns and villages, it has left the choice of adopting or neglecting precautionary measures almost entirely to the people themselves. In villages the only occasion on which compulsion may now be resorted to for the adoption of any precautionary measures is in the case of evacuation, and even here compulsion may be applied only to an inconspicuous minority who refuse to leave their houses in opposition to the wishes of the remainder of their fellow villagers. In towns compulsory action is limited to the isolation of houseless or unattended persons suffering from plague. Chemical disinfection by official agency is still advocated both in towns and villages, but in villages it is limited to the initial stage of a fresh outbreak of plague, and in towns, although it is directed that the free disinfection of infected houses and rooms should be offered throughout the epidemic, it is directed to be carried out only if the owners consent to have their clothing and other belongings disinfected. In cases where chemical disinfection is not carried out, the desiccation of infected houses and rooms has been advocated. Inoculation is still freely offered to the people, and all dispensaries in the province in charge of Assistant Surgeons have been provided with inoculation equipment.

Plague in the North-West Frontier Province.—In the North-West Frontier Province during 1903 the number of deaths recorded as due to plague was 49, as

compared with four in 1902. All the deaths occurred in the Hazara district. The earlier cases were probably imported from Dhariwal near Gujranwala, Wazirabad, and Rawalpindi. There was no plague west of the Indus.

Plague in the Central Provinces.—The epidemic of plague which had commenced in the Central Provinces at the end of 1902 extended rapidly and spread widely. During 1903 no fewer than 35,335 deaths from this disease were recorded in the Central Provinces, and even this number is not considered by the provincial Sanitary Commissioner to nearly represent the true plague mortality. He was of opinion that many deaths recorded under the headings of "fevers" and "other causes" were really due to plague, and considered that the actual plague mortality probably exceeded the recorded mortality by about ten per cent. The highest death-rates recorded in districts were 21·95 per 1,000 in Burhanpur, 20·34 in Nagpur, 13·30 in Jubbulpore and 12·75 in Hoshangabad. In the town of Kamptee in the Nagpur district the very high death-rate from plague of 108·11 per 1,000 was recorded, and in the town of Nagpur the high rate of 75·17. Death-rates of between 50 and 60 per 1,000 of population were recorded in the towns of Hoshangabad and Harda in the Hoshangabad district, Barhanpur in the Barhanpur district and Jubbulpore. There were two distinct periods of plague prevalence—the first continued from the previous year and terminated early in May; the second commenced in August and lasted till the end of the year. The highest mortality during the first epidemic occurred in March, and during the second epidemic in November. The attitude of the people in general is said to have undergone a change for the better; they have begun to realize that unless they protect themselves the State can do but little for them. They understand the value of evacuation and the desirability of temporarily excluding arrivals from infected areas. Both inoculation and chemical disinfection are said to be unpopular.

Plague in Berar.—Plague made its first appearance in Berar in 1902, during which year 4,188 deaths from it were recorded. In 1903 the number of deaths reported as having been due to plague in Berar was 16,179. All the districts were more or less affected, and out of a total of 43 towns only eight escaped. A death-rate from plague of 93·12 per 1,000 was recorded in the town of Amraoti and rates of 60 per 1,000 or over were returned in five other towns.

Plague in Madras Presidency.—The total number of deaths from plague recorded in the Madras Presidency during 1903 was 13,006, as compared with totals of 11,362 in 1902 and 3,035 in 1901. As in the previous year the disease was most prevalent during 1903 in the Bellary district, in which it was responsible for a total of 5,896 deaths and a death-rate of 6·2 per 1,000 of population. The Nilgiris came next with a death-rate of 5·6 per 1,000. Out of the total of 22 districts in the Madras Presidency, the disease was during 1903 indigenous in eight and four were entirely free. The highest death-rates from plague recorded in towns were 113·7 per 1,000 in Vaniyambadi, 33 in Tirruppattur, both in the Salem district, 26·5 in Hospet, 20·6 in Rayadrug, both in the Bellary district, and 14·2 in Coonoor and 13·2 in Ootacamund, both in the Nilgiris.

Plague in the Bombay Presidency.—In the Bombay Presidency during 1903 the total number of deaths recorded as due to plague was 281,269, an excess of nearly 100,000 over the figures of 1902, and considerably the largest number recorded in any province during the year. In 1903 the Bombay Presidency has gained the unenviable distinction of being the first, and so far, the only, province in which the recorded mortality from plague has exceeded that from "fevers." The mortality recorded from plague in this Presidency during 1903 was the highest since the commencement of the epidemic in 1896, and all districts were affected except Thar and Parkar and the Upper Sind Frontier.

Plague in the City and Port of Bombay.—In the City of Bombay 20,751 deaths from plague were recorded during 1903, as compared with 18,694 during 1902. The disease prevailed in epidemic form from January to May inclusive. At the inspections of outgoing and incoming vessels and of vessels lying in the harbour, 97 cases of plague were detected. Among the passengers and crew who were sent to the port observation camp from the outward inspections, 39 developed plague and were sent to the Modikhana hospital for treatment.

Plague in Burma.—Only ten cases of plague—all imported—occurred in Burma during 1903. Five of the cases were detected in the port of Rangoon at the medical inspections imposed on all incoming vessels arriving from India or other infected ports. Two cases occurred at Moulmein on a steamer from Bombay and two on a steamer from Calcutta. The remaining case was that of a military policeman who arrived in Rangoon town from Satara in the Bombay Presidency. The successful resistance to the invasion of plague from infected centres justifies the stringency with which the rules in force in Burma have been carried out.

Plague in Baluchistan.—In Baluchistan three deaths from plague were reported during 1903 as compared with 30 during 1902. There were in all only four cases reported during the year. All were imported cases and the disease did not spread.

Plague in Rajputana and Ajmer-Merwara.—In Rajputana 2,442 deaths from plague were recorded during 1903 as compared with 149 during 1902 and 185 during 1901. In the Banswara State plague was indigenous at the commencement of the year, but by energetic measures and prompt evacuation of infected areas the spread of the disease was stopped, and from May until the end of the year the State was free from indigenous plague. In the Alwar State plague appeared in February, but was not reported until March. The State was free from the disease during July and August, but was re-infected from the Punjab in September. In the Mewar State 676 deaths from plague were recorded; in the Banswara State 648 deaths; in the Alwar State 420 deaths, and in Tonk 326 deaths. In Ajmer-Merwara 48 deaths from the disease were recorded.

Plague in Central India.—Plague commenced in Central India at the end of September, 1902, and continued with great severity throughout the year 1903, during which no fewer than 26,169 deaths from the disease were recorded as compared with only 408 in the previous year.

Plague in Mysore.—The total number of deaths recorded as due to plague in Mysore during 1903 was 20,223 as compared with 26,301 in 1902. Disinfection of clothing and houses with a solution of perchloride of mercury, and desiccation of houses by burning dried cowdung cakes in them, were the measures upon which most reliance was placed.

Plague in the Hyderabad State.—The total number of deaths recorded from plague in the Hyderabad State during 1903 was 28,094 as compared with 8,934 in 1902. The epidemic, which had prevailed during the previous year, attained its maximum intensity in February, 1903, and then quickly declined in severity, almost ceasing in June. In July, however, a recrudescence occurred, and the number of deaths recorded in December was almost equal to that recorded in February. The largest numbers of deaths were reported in the districts of Aurangabad, Bir, Usmanabad, and Lingsugar.

Fevers.

The total number of deaths recorded under the heading of fevers during 1903 was 4,459,237, or a ratio of 19.66 per 1,000 of population as compared with a total of 4,279,551 or a ratio of 19·17 during 1902. As in the previous year the increase in the mortality from fevers during 1903 was coincident with a very large increase in the prevalence of plague, and it is probable that many deaths from plague were returned as having been due to "fever." The year 1903 was, however, in all respects more unhealthy than 1902, and, although year by year it becomes more apparent that malarial fevers are a factor of less importance as a cause of death than has been generally supposed, it is not improbable that some portion of the increased mortality may have been due to an increase in the prevalence of malarial fevers. The greatest number of deaths from fevers was, as usual, recorded during the last three months of the year, but the excess in mortality during these three months was not nearly so great as might have been expected if malarial fever were the chief factor causing the deaths reported under the heading of fevers; and with the exception of these three months the largest number of deaths was recorded in June, the month during which malarial fevers are least prevalent over by far the greater part of the country. Some idea of the use that is made by village agencies

in Bengal of the heading "fevers" is given in the report of an enquiry carried out in the district of Dinajpur in Bengal by Captain Rogers, I.M.S. This officer sought out the relaives of 1,000 people whose deaths had been recorded by the reporting agents in villages of that district during 1903 under the heading "fever," and enquired from them the symptoms, course, and duration of the illness in case. He concluded that 318 of the deaths had been due to acute or chronic malarial fevers, 217 had been due to pneumonia, 90 to phthisis, 23 to bronchitis, 102 to diarrhœa, 18 to enteric fever, 61 to dysentery, 104 had occurred in infants who had been "born feeble," and 67 had been due to "other causes."

Table showing the deaths from Fever registered in British Provinces by Months during the year 1903.

PROVINCE.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL. 1903.	RATIO OF DEATHS PER 1,000 OF POPULATION. 1903.
Bengal	141,131	119,626	146,400	138,130	130,800	130,847	121,133	127,209	129,744	129,560	168,794	171,567	1,654,941	22·23
Assam	5,849	5,092	5,369	5,770	5,906	6,658	7,497	6,437	5,922	6,526	6,852	7,126	75,004	14·22
United Provinces	93,842	79,761	88,331	108,272	123,935	128,142	119,894	94,978	105,322	125,121	131,711	119,210	1,318,519	27·65
Punjab	41,223	33,783	34,444	34,864	36,861	37,432	30,386	26,682	37,825	59,768	75,562	60,477	509,307	25·33
North-West Frontier Province	4,506	3,228	2,839	2,530	3,051	3,388	3,181	2,614	2,471	3,812	5,134	5,795	42,549	21·37
Central Provinces	13,193	12,742	13,297	16,224	16,365	18,091	13,629	14,424	17,030	18,710	19,976	17,026	190,707	15·27
Lower Burma	4,653	3,673	3,996	3,666	3,616	3,841	5,414	5,534	4,978	4,624	5,344	6,449	55,788	10·14
Upper „	1,613	1,422	1,874	2,062	1,815	1,594	2,020	1,670	1,520	1,654	2,079	2,707	22,030	7·63
Madras Presidency	26,199	21,997	23,318	22,198	22,937	24,631	26,210	27,864	27,200	28,224	29,673	34,475	314,926	8·4
Bombay „	28,850	25,208	24,045	22,356	17,632	15,631	15,773	18,614	18,768	21,641	25,384	25,802	259,704	14·05
Ajmer-Merwara	936	951	890	757	849	750	462	682	1,030	1,076	1,198	1,411	10,992	23·05
Coorg	302	274	336	339	416	479	484	528	469	348	402	393	4,770	26·41
Total	362,297	307,757	345,139	357,168	364,183	371,484	346,083	327,236	352,279	401,064	472,109	452,438	4,459,237	19·66

In Bengal the death-rate from fevers during 1903 was 22·23 per 1,000 of population against 23·13 in 1902. The majority of deaths occurred in November and December, but a very large number were returned in March, coincident with the maximum period of plague mortality. The highest death-rate from fevers during the year was recorded in the district of Dinajpur, and after the close of the year Captain Rogers, I.M.S., was deputed to make a special enquiry into the cause of the great unhealthiness of this district. The results of that portion of his enquiry which referred to the incorrectness of the diagnoses made by reporting agents in villages have been briefly noted above. This part of his investigation occupied so much time that he was unable to do much microscopic work, but in the spleen blood of 30 cases suffering from fever and enlargement of the spleen he found malaria parasites in five and the parasites which are presumed to be the cause of *kala azar* in ten. The latter parasites have also been found as a cause of fever in other parts of Bengal. Some cases of so-called "Burdwan fever" have been shown by Captain James, I.M.S., to be of this nature and also some cases of fever occurring in Dacca. It would be of interest to ascertain whether the natives in Dinajpur and other districts of Bengal where a high mortality from fever is recorded, regard the dangerous fever from which they suffer as malarial fever or whether, like the natives of Assam, they regard it as so essentially different as to require a special name. In Assam the death-rate from fevers during 1903 was 14·22 per 1,000, as compared with 14·72 in 1902 and 15·86 in 1901. The total number of deaths recorded as due to *kala azar* in 1903 was 5,033. Since 1897 there has been a steady decrease in the number of deaths recorded year by year from this disease, but Captain James, I.M.S., who has lately made a tour of investigation in Assam, expresses the opinion that *kala azar* is much more prevalent than is generally thought to be the case. There is no very obvious reason why the death-rate from dysentery and diarrhœa in Assam should be so much higher than in Bengal, and it is possible that many deaths from *kala azar*, which frequently terminates with dysenteric symptoms, are returned under the heading of bowel complaints. The tables given by the provincial

Sanitary Commissioner show that while 5,033 deaths from *kala azar* were recorded, only 833 cases of the disease were treated in the dispensaries throughout the province. These figures indicate on the one hand either that the people have no faith in the treatment provided at the dispensaries in Assam, or on the other hand that the diagnoses made by reporting agents in districts, or those made at the dispensaries, are incorrect. All these factors are undoubtedly at work, but, in the light of recent knowledge, the erroneous diagnosis of cases treated at dispensaries is undoubtedly a chief factor to which the discrepancy between the number of cases treated in these institutions and the number of deaths recorded in districts, must be attributed. In a village within two miles of the Gauhati dispensary Captain James found that over 20 per cent. of the people were suffering from *kala azar*, but only eight cases of the disease had been recorded in the books of the Gauhati dispensary as having been treated during 1903. The disease was also found to be very prevalent in the areas adjoining the Tezpur and Mangaldai dispensaries, but only eight cases were recorded as having attended at the former dispensary during 1903 and only 18 at the latter.

The death-rate from fevers in the United Provinces during 1903 was higher than in any other province of India, and 3·14 per 1,000 higher than in 1902. Some of the increased mortality returned under this heading may have been due to plague and some to measles, which is said to have caused even more deaths than plague. The towns of Meerut and Farrukhabad, in which death-rates from "fevers" of 52·64 and 43·92 per 1,000, respectively, were returned, are reported by Captain James to be only slightly malarious, and there are reasons for thinking that a considerable number of the deaths recorded under the heading of fevers in these and other towns in the province were due to broncho-pneumonia, occurring perhaps as a complication of measles.

In the Punjab the death-rate from fevers during 1903 was 25·33 per 1,000 of population, as compared with 23·54 in 1902. There is no reason to doubt that in this province, at any rate, most of the deaths recorded as due to fevers are really due to malarial fever. The monthly rise and fall in the mortality from fevers corresponds very accurately with the known seasonal incidence of malarial fevers in this province, and the sudden great increase in mortality during October, November, and December, can scarcely be due to any other cause than malaria. Moreover, from the examination in the Punjab of a considerable number of cases of fever associated with great enlargement of the spleen, and sometimes of the liver, Captain James concludes that such cases occurring in the Punjab are malarial in origin, and are not the result of infection with the new parasite which in some other parts of India seems likely to prove to be such an important cause of death. In the North-West Frontier Province the death-rate from fevers during 1903 was 2·45 per 1,000 higher than during 1902. In the Central Provinces and Berar, 190,707 deaths from fevers were recorded during 1903, equal to a ratio of 15·27 per 1,000 of the population. With few exceptions in the districts of the Central Provinces in which plague prevailed, an increase in mortality from fevers was recorded during 1903, but in the Berar districts in which plague prevailed the recorded mortality from fevers was considerably reduced. In Lower Burma the death-rate from fevers was 1·28 per 1,000 higher than in 1902, and in Upper Burma fevers were also more prevalent during 1903 than during the previous year.

In the Madras Presidency the ratio was 8·4 per 1,000, against 7·65 per 1,000 in 1902. A death ratio of 12·3 per 1,000 was recorded in the town of Madras as compared with ratios of 14·7 in 1902 and 18·3 in 1901. The comparatively high death-rate from fevers annually recorded in Madras town has for several years been difficult of explanation except on the grounds of inaccurate diagnosis, for the theory which had so long prevailed that malarial fevers were very common and severe in Madras town was shown in 1902 to be incorrect. The explanation is now forthcoming in the discovery made by Major Donovan, I.M.S., that the cases of fever associated with enlargement of the spleen which are so common in Madras are really not cases of malaria at all, but are caused by the parasite discovered by Major Leishman. The disease is, in fact, identical with that which has been so long known to the natives of Assam under the term *kala azar*. In Bombay the mortality from fevers during 1903 declined somewhat, as compared with the previous year. Since 1897 the falling off in the number of deaths ascribed to fevers in Bombay has been remarkable. In the six years ending 1897 the aggregate number of recorded fever deaths was 2,432,935 while in the six years 1898-1903 the aggregate

was 1,810,581, a decline of 622,354; this is, no doubt, largely due to the decrease in the number of the total population, but the later six years includes the large total of 543,319 recorded in 1900, and it is evident that there has been considerable change in the classification of deaths by the reporting agencies. The total number of deaths in the six years ending with 1903 exceeds the total of the six years ending with 1897 by 1,143,318, the details showing a decline of 622,354 in the total number of deaths recorded as due to fever and of 1,254 in the total number of deaths ascribed to cholera, and increases of 1857 from small-pox, 761,233 from plague, 263,693 from dysentery and diarrhœa, 118,728 from respiratory diseases, 6,640 from injuries and 614,775 from other causes.

Anti-mosquito operations.—In Bengal steps were taken for the organisation by private enterprise of agencies for the destruction of mosquitoes, but the provincial Sanitary Commissioner remarks that, from the reports received, it appears very little was done, and that the people were very apathetic in the matter. A "mosquito brigade" consisting of ten men under the supervision of a Hospital Assistant was, however, formed in Puri town, and worked there for some months. No organised operations on a large scale were initiated in the United Provinces, but increased efforts were made in many localities to improve surface drainage, and to bring quinine more generally within the reach of the poorer classes. In the Punjab trial measures for the destruction of mosquitoes were initiated during the year in the towns of Gujranwala and Gujrat, but the severe prevalence of plague prevented their being carried out in a systematic way. In the Central Provinces it had been intended to carry out systematic operations during 1903 in five selected towns. In the town of Bhandara nothing special was done owing to want of funds. In Bilaspur nothing was done, pending the introduction of a drainage scheme, of which the town is badly in need. In Hoshangabad a special gang of coolies under the direction of the Civil Surgeon cleaned out pools and drains likely to become breeding places of mosquitoes during September, October and November, but little else appears to have been done. In Mandala the Municipal Committee placed three coolies at the disposal of the Civil Surgeon; a number of pits and pools were filled up, drains cleaned out and levelled and an effort made to prevent the destruction of fish in the river which waters the town. In Khandwa eight men worked under the Civil Surgeon's orders throughout the year. A large number of pits and hollows were filled up and pools periodically swept out. The use of kerosine oil was discontinued, as it was not found possible to direct the main expenditure of the oil in the proper direction. The plague epidemic of 1903 made it difficult to say whether the fever mortality of Khandwa was affected by the measures. The main dispensary returns showed a smaller attendance for malarial fevers than in 1902, but the general attendance was also less by reason of plague. In Madras the local Government has directed that funds be allotted by local bodies for experiments in six carefully selected areas, having for their object the extermination of malaria by the destruction of mosquito larvæ, minor engineering works and the administration of quinine. The officer selected for the duty will work under the office of the provincial Sanitary Commissioner, and will have attached to him an intelligent engineering subordinate.

Sale of Quinine.—In Bengal there was a considerable reduction in the number of packets of quinine sold during 1903, only 28,595 parcels (each containing 102 five grain packets) being disposed of as compared with 34,114 parcels in 1902. The reduction is considered to have been due to the lesser prevalence of fever during 1903 than during 1902.

In Assam the sale of quinine increased slightly during 1903, a total of 1,547 parcels, each containing 102 five grain packets, being disposed of, as compared with 1,434 parcels in 1902.

In the Central Provinces the sale of quinine showed a steady increase, 3,550 parcels, each containing 102 five grain packets, being sold, as compared with 2,681 in 1902. In Berar 3,321 parcels were sold, or 770 less than in 1902.

In the United Provinces 236,131 packets of quinine—137,463 being five grain packets and 98,668 seven grain packets—were sold in 1903 against 224,999 in 1902. Quinine was sold in post offices in all districts except Gonda, but it was sold by vaccinators only in 29 and by landlords in 12 districts. In the Punjab quinine was, as usual, gratuitously distributed during the year in a large number of districts

but no information regarding the sale of the drug is contained in the provincial Sanitary Commissioner's report.

In Burma 192,751 five grain packets of quinine were sold through the medium of post offices in 1903, as compared with 179,708 in the previous year. Quinine was also sold by vaccinators in villages, but the number of packets disposed of in this way during 1903 was only 230.

Details are wanting regarding quinine sales in the North-West Frontier Province, Madras, and Bombay.

Dysentery and Diarrhœa.

The number of deaths recorded under the heading of dysentery and diarrhœa rose from 235,750 in 1902 to 273,459 in 1903, and the death-rate per 1,000 of population from 1·06 to 1·21. The increased mortality was due chiefly to a severer prevalence of the diseases in the United Provinces, the Central Provinces, the Punjab, and the Madras Presidency. In Bengal, Assam, and the Bombay Presidency the mortality from dysentery and diarrhœa was the same during 1903 as during 1902, though the total number of deaths recorded during 1903 was slightly less. The districts in which the highest death-rates were recorded were Howrah, Darjeeling, Cuttack, Puri, Patna, Calcutta and Hoogly. The urban mortality was, as usual, much higher than the rural. In all the districts of Assam except Kamrup, Goalpara and Nowgong, the death-rates from dysentery and diarrhœa during 1903 were lower than during 1902, and the ratio for the province as a whole was considerably reduced. The provincial Sanitary Commissioner is of opinion that although some part of the higher mortality from dysentery and diarrhœa recorded among tea-garden coolies than among the general population is only apparent, being due to the fact that cases

Table showing the Deaths from Dysentery and Diarrhœa registered in British Provinces, by months, during the year 1903.

Provinces.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total. 1903.	Ratio of deaths per 1,000 of population. 1903.
Bengal	5,039	4,226	4,860	4,388	4,092	4,658	5,002	5,687	4,687	3,966	4,680	5,354	56,639	·76
Assam	755	597	603	794	1,172	1,019	929	876	920	1,004	901	946	10,516	1·99
United Provinces	2,063	1,702	2,433	3,740	4,645	4,830	4,579	4,002	3,578	3,334	2,981	2,773	40,660	·85
Punjab	968	741	797	1,029	1,549	1,437	1,150	1,264	1,938	2,116	2,013	1,496	16,498	·82
North-West Frontier Province	51	35	27	29	35	66	49	49	46	67	45	54	553	·28
Central Provinces	1,586	1,707	1,981	2,022	1,928	2,307	2,994	3,777	4,738	4,272	3,203	2,666	33,181	2·66
Lower Burma	519	471	489	483	752	965	1,129	1,141	763	605	745	801	8,863	1·61
Upper „	34	35	47	51	123	103	174	182	118	86	103	69	1,125	·39
Madras Presidency	3,781	3,168	3,274	3,161	3,465	4,429	5,689	5,299	4,391	4,021	3,906	4,805	49,389	1·3
Bombay „	4,715	4,203	3,613	3,885	3,835	4,198	5,009	6,189	5,787	5,239	4,517	4,253	55,443	3·00
Ajmer-Merwara	46	29	25	36	43	36	21	35	75	47	36	26	455	·95
Coorg	5	2	11	5	11	23	11	20	11	17	9	12	137	·76
Total	19,562	16,916	18,160	19,623	21,650	24,071	26,736	28,521	27,052	24,774	23,139	23,255	273,459	1·21

of anæmia and other diseases are often returned by tea-garden hospital assistants under the heading of the symptoms (dysentery and diarrhœa) by which they are terminated, yet there is in reality a greater mortality from dysentery in tea gardens than elsewhere. In the United Provinces the death-rate from dysentery and diarrhœa during 1903 was considerably higher than during 1902. The urban death-rate was 2·38 per 1,000, and the rural ·73 per 1,000. The mortality in some districts was unusually high, notably in Garhwal, Almora, Fyzabad, Ballia and Unao. The recorded mortality from dysentery and diarrhœa in the Punjab was also increased. The greatest numbers of deaths were returned during the months when malarial fevers were most prevalent. The death-rates from dysentery and diarrhœa in all the districts of Berar and in nearly all the districts of the Central Provinces were considerably higher in 1903 than in 1902. The death-rate recorded in Berar was more

than three times as high as that recorded in the Central Provinces, and the month of maximum mortality was October in Berar and September in the Central Provinces. In Madras the death-rate from dysentery and diarrhœa was 1·3 per 1,000 in 1903, as compared with 1·01 per 1,000 in 1902. The death-rate in municipalities was four times as high as in rural areas. In Bombay the total number of deaths and the death-rate per 1,000 from dysentery and diarrhœa were somewhat reduced. The mean annual number of deaths returned under this heading during the six-year period since 1898 is more than double the mean annual number so returned during the six-year period from 1892 to 1897. In Lower Burma the death-rate from dysentery and diarrhœa in 1903 was 1·61 per 1,000 as compared with 1·30 in 1902, and in Upper Burma it was ·39 as compared with ·23. Cholera was prevalent in Upper Burma and some of the mortality recorded as due to dysentery and diarrhœa may have been due to this disease. In Ajmer-Merwara 455 deaths were attributed to dysentery and diarrhœa; and 137 in Coorg.

General History of Vaccination.

Vaccination in India.—The aggregate number of operations performed in 1903-04 by all public agencies in all the provinces was 8,457,298, against 8,431,564 in the preceding year, and 8,036,444 in 1901-02. In every province except Bengal, Assam, Madras and Coorg, there was an increase, which in most cases was limited to primary operations. The mean number of vaccinations performed by each vaccinator fell from 1,460 in 1902-03 to 1,458 in 1903-04, ranging from 2,635 in the Punjab to 880 in Ajmer-Merwara.

Primary operations totalled 7,916,262 against 7,791,858 in the preceding year, there being an increase in the number performed in every province except Assam, Madras and Coorg. In Assam where there was much less small-pox than in 1902-03, vaccination was impeded in Lakhimpur by the presence of measles, and there was a falling off in the work done on tea gardens in Cachar. In Madras the falling off is explained by the decrease in the prevalence of small-pox, by insufficient and irregular supplies of lymph in certain places, and by the absence of vaccinators. In Coorg, although small-pox was more prevalent than in the preceding year, some of the vaccination staff were employed on duties in connection with plague.

Revaccinations declined in number from 639,706 in 1902-03 to 541,036, the decline taking place in all the provinces except the Central Provinces and Berar, Burma and Ajmer-Merwara. In all provinces in which there was a falling off, except the United Provinces, the Punjab, the North-West Frontier Province and Coorg, small-pox was less prevalent than in the preceding year, and in all except the North-West Frontier Province plague was prevalent. The falling off in the number of revaccinations in the United Provinces was slight, but in the Punjab it was considerable and in the North-West Frontier Province very great. In the Punjab there was a great extension of the prevalence of plague, and it is stated that there has been a lack of system in the proceedings of the vaccinators, while a rule was introduced to prevent the repeated revaccinations of children for the purpose of swelling the returns. In the North-West Frontier Province the falling off seems to have been largely due to ill-health among the people and among the vaccinators.

The number of operations performed at dispensaries fell from 208,733 to 195,730, including 128,945 in Bengal, 21,078 in Assam, 16,106 in the Central Provinces and Berar, 13,930 in Burma and 12,854 in Madras; elsewhere dispensary vaccination was unimportant or non-existent.

The mean percentage of success in primary operations fell from 95.10 to 95.05, ranging from 99·17 in Ajmer-Merwara and 99·13 in the Punjab to 84·98 in Burma. The mean percentage of success in revaccinations also fell fractionally from 68·20 to 68·19, ranging from 88·21 in the United Provinces to 43·65 in Burma.

The mean proportion of the population successfully vaccinated rose from 33·14 per 1,000 in 1902-03 to 33·32 in 1903-04, ranging from 48·67 in Coorg and 44·28 in Assam, to 27·42 in Ajmer-Merwara and 24·63 in Bombay.

Estimating the birth-rate in each province at 40 per 1,000, the percentage of infants protected during the year rose from 39·15 in 1902-03 to 39·53, but the percentages in the provinces varied greatly, from 66·73 in the Central Provinces and Berar and 58·23 in the Punjab, to 26·29 in Assam, 19·0 in Burma and 11·63 in Coorg.

Total Primary and Re-vaccinations, successful cases among the children, cost of the Special Vaccination Department, &c., during the official year 1903–04.

PROVINCES.	NUMBER OF PERSONS VACCINATED BY THE SPECIAL AND DISPENSARY STAFFS COMBINED.		PERCENTAGE OF SUCCESSFUL CASES TO TOTAL OPERATIONS.		NUMBER OF CHILDREN SUCCESSFULLY VACCINATED BY THE SPECIAL AND DISPENSARY STAFFS COMBINED.		Average number of operations performed by each vaccinator of the Special Staff.	Total Cost of the Special Department.
	Primary.	Re-vaccinations.	Primary.	Re-vaccinations.	Under One Year.	One to Six Years.		
								Rs.
Bengal	2,634,563	114,075	98·18	66·40	877,810	1,519,276	978	1,84,988
Assam	273,477	5,325	97·87	81·86	64,415	182,076	988	24,381
United Provinces of Agra and Oudh	1,564,469	102,635	97·83	88·21	965,613	470,477	1,837	1,43,817
Punjab	604,204	80,901	99·13	76·25	472,669	99,624	2,635	92,017
North-West Frontier Province*	93,096	4,914	92·67	79·91	41,315	21,211	2,610	14,484
Central Provinces and Berar	547,812	98,493	98·52	74·32	390,452	123,627	1,988	67,338
Madras Presidency	1,240,655	69,330	89·02	68·95	423,584	544,825	1,529†	2,65,625
Coorg	8,052	1,601	93·47	79·13	840	4,599	1,027	2,667
Bombay Presidency	552,101	35,832	92·51	55·02	419,728	84,302	1,377	2,69,068
Burma	384,722	27,842	84·98	43·65	79,650	182,157	1,780	94,331
Ajmer-Merwara	13,111	88	99·17	82·95	10,213	2,443	880	2,517
TOTAL	7,916,262	541,036	95·05	68·19	3,746,289	3,234,617	1,458	11,61,233

* 1,166 cases vaccinated in the dispensary have been excluded, the result being not known.
† Excludes average of work done by each medical subordinate.

Vaccination operations performed by the Special and Dispensary Establishments separately, Deaths from Small-pox, &c., during the official year 1903–04.

PROVINCES.	Population.	NUMBER OF PERSONS VACCINATED (PRIMARY AND RE-VACCINATIONS COMBINED).			Ratio of successful vaccinations per 1,000 of population.	Percentage of annual estimated births at 40 per 1,000 of population successfully vaccinated.	DEATHS FROM SMALL-POX*.	
		By Special Department.	By Dispensary Staff.	Total.			Number.	Ratio per 1,000 of population.
Bengal	74,735,533	2,619,693	128,945	2,748,638	35·62	29·36	30,459	·40
Assam	6,126,343	257,724	21,078	278,802	44·28	26·29	1,111	·21
United Provinces of Agra and Oudh	47,960,667†	1,666,564	540‡	1,667,104	33·20	50·33	21,950	·46
Punjab	20,293,834	685,078	27	685,105	31·15	58·23	15,635	·78
North-West Frontier Province§	2,092,713	98,010	—	98,010	43·10	49·36	2,694	1·35
Central Provinces and Berar	14,627,045	630,199	16,106	646,305	41·07	66·72	2,136	·17
Madras Presidency	38,408,531	1,297,131	12,854	1,309,985	30·00	27·57	15,015	·4
Coorg	180,607	9,245	408	9,653	48·67	11·63	43	·24
Bombay Presidency	21,539,199	586,091	1,842	587,933	24·63	48·72	2,732	·15
Burma	10,477,508	398,634	13,930	412,564	32·36	19·00	1,920	·23
Ajmer-Merwara	476,913	13,199	—	13,199	27·42	53·54	4	·01
TOTAL	236,918,892	8,261,568	195,730	8,457,298	33·32	39·53	93,693	·41

* For the calendar year.
† Includes 16,010 persons enumerated at the Ajodhya fair.
‡ No special vaccinators are attached to dispensaries. Operations performed by medical subordinates.
§ 1,166 cases vaccinated in the dispensary have been excluded, the result being unknown.

Preservation of calf lymph.—In this report for 1902 mention was made of the researches in the preservation of animal lymph by means of the admixture of

glycerine and of vaseline which had been carried out by Captain W. F. Harvey, I.M.S. Those researches have been extended, and at the suggestion of Lieutenant-Colonel Bamber, Sanitary Commissioner of the Punjab, experiments have been made on the use of chloroform as a purifier after the method described by Dr. A. B. Green. Those experiments have been most successful. It was found that the passage of the vapour of chloroform through lymph pulp suspended in sterile water, with or without the addition of glycerine, killed all except spore-bearing and very resistant bacteria, and that from three to six hours treatment with chloroform vapour was practically equal in purifying effect to treatment by means of glycerine for a month. It appears, however, that the purification effected by chloroform is similar in kind and degree to the purification effected by glycerine, the difference is in speed, and the advantage of the use of chloroform depends upon this. If lymph is preserved in glycerine and kept at a low temperature, deterioration of the vaccine virus is very slow, but the extraneous organisms do not die quickly. If the preserved lymph is kept at a high temperature, the extraneous organisms are soon killed, but the vaccine virus is injured. The preliminary treatment by chloroform vapour kills most of the extraneous organisms and the lymph can be kept in glycerine at a low temperature for a long time without losing its protective power. If the lymph is to be kept the addition of a preservative after the treatment with chloroform is necessary, otherwise those bacteria which have not been killed by the chloroform will multiply. Glycerine seems to be the best preservative, because, although it may not kill the organisms that chloroform has failed to kill, it prevents their multiplying.

It was found that:—

"(*a*) There is but little difference between lymph that has been glycerinated before and that which has been glycerinated after being chloroformed.

"(*b*) After chloroforming practically no further purification is effected by glycerine when lymph is kept at a low temperature.

"(*c*) Lymph which is glycerinated only and kept at a low temperature will become purified but slowly.

"(*d*) Lymph which has been chloroformed only and had no preservative added will show a great and rapid increase of micro-organisms at the end of a month even although kept at a low temperature."

Captain Harvey's further experiments show that glycerinated lymph is in all respects superior to vaselinated lymph.

Bengal.—The total number of persons vaccinated in Bengal during the season 1903-04 was 2,748,638, as compared with 2,781,972 in the preceding season. Of the total operations performed 2,634,563 were primary and 114,075 revaccinations, the corresponding figures in 1902-03 having been 2,592,177 and 189,795. There was, therefore, an increase of 42,386 primary operations and a decrease of 75,720 revaccinations, equal to a decrease of 33,344 in the total number of operations. The average number of operations performed by each vaccinator was 961, against 972 in 1902-03. The percentages of success claimed were 98·18 in primary operations and 66·40 in revaccinations, against 98·11 and 68·07, respectively, in the preceding season. In 28 of the 49 districts the numbers of operations increased, most notably in Faridpur 23,788, Mymensingh 14,355, Rangpur 14,347, Cuttack 12,264, all districts in which small-pox was much less fatal than in 1902-03. In the remaining districts the decrease in the numbers of operations was greatest in Midnapore 54,286, Dinajpur 17,561, Balasore 17,342, Manbhum 12,546, in all of which the small-pox mortality had largely declined. The falling off in the number of operations generally is attributed to the diminution in the prevalence of small-pox, the mortality from which fell from ·58 to ·33 per 1,000, to illness and misbehaviour of vaccinators, and the prevalence of malaria in some eastern districts, and of plague in the western districts. But the opinion of the Local Government is that the Department, as at present constituted, is unable to cope with the requirements of the province, and proposals for re-organising it and increasing the superior staff so as to secure adequate supervision are under consideration.

The vast majority of the operations, 2,006,716, were performed with human lymph; 212,537 were performed with calf lymph, and 415,310, an increase of 16,105 as compared with the previous season, with lanolinated lymph, the ratios of success claimed being with human lymph 98·35 per cent. as compared with 98·38 in 1902-03, with calf lymph 98·83, against 98·13, and with lanolinated lymph 97·01 against 96·75

Of the estimated number of children available, 29·36 per cent. were protected against 29·92 in the previous year; in fifteen districts the percentage protected was over 50, but in Tippera, Mymensingh, Midnapore, the Tributary States of Orissa, Puri, Noakhali, Cuttack and Balasore it was under 20. In municipal towns the number of children protected was 71·1 per cent. against 72·3 in 1902-03. The falling off in the percentage of children protected, which is calculated on a hypothetical birth-rate of 40 per 1,000 is, no doubt, in part due to a falling off in the number of births, of which 84,609 fewer were registered in 1903 than in 1902.

The quantity of lymph paste manufactured at the Calcutta depôt rose from 103,470 grains in 1902-03 to 130,680 grains, the demands from the districts, especially from Orissa, Faridpur and Backergange having increased. At Darjeeling the quantity manufactured increased by 1,488 grains to 49,189 grains, of which 515 and 630 grains were supplied to the Nepal Darbar and the Sikkim State, respectively.

Assam.—The total number of operations performed by all agencies in Assam in 1903-04 was 278,802, or 25,319 fewer than in the previous year, and 2,025 fewer than in 1901-02. Of the total 273,477 were primary operations with a percentage of success at the rate of 97·87, and 5,325 were revaccinations, of which 81·86 per cent. succeeded; in 1902-03 primary operations numbered 291,332 and revaccinations 12,789, the success claimed being 97·90 and 77·81 per cent. respectively. A falling off in the numbers of operations occurred in eight of the 13 districts, ascribed in Sylhet to a decline in the special activity induced by the prevalence of small-pox in 1902-03; in Lakkimpur to an outbreak of measles; in Nowgong to the absence of a vaccinator for four months; in the Naga Hills to a more careful check of the work of the operators, and in the Garo and Lushai Hills to the unwillingness of the people to be vaccinated in the absence of small-pox. The number of persons vaccinated by each vaccinator, excluding dispensary and tea gardens' agencies, averaged 988 against 999 in the preceding season.

Estimating the number of infants available at 40 per thousand of the population, 26·29 per cent. were protected during the year. In the municipal towns where the number of available children is deduced by deducting the number of recorded deaths from the number of registered births, a mean of 67·77 per cent. were protected, the figures varying between 85·71 in the Union of Golaghat and 39·41 in Gauhati.

At the vaccine depôt 429,080 tubes of lymph were obtained from 444 calves, an average of 966·39 per calf, and were distributed throughout the province. Complaints were received regarding the quality of certain early supplies, which it seems probable were kept too long before use.

United Provinces.—In spite of the continued increase of plague, the number of vaccinations rose from 1,665,253 in 1902-03, to 1,667,104 in 1903-04. The increase was in the number of primary operations which rose from 1,562,070 to 1,564,469, while the number of revaccinations fell from 103,183 to 102,635, the percentages of success being 97·83 and 88·21, against 97·90 and 88·41, respectively. In 28 districts, including the native State of Tehri-Garhwal there was an increase in the number of successful primary operations, and in 21 there was a decrease, due in the cases in which the falling off was greatest to the presence of plague. The average number of persons vaccinated by each vaccinator was 1,837, as compared with 1,840 in the previous year. Of the number of children in the province estimated as available, 50·33 were successfully vaccinated; in municipalities the percentage of available children protected was 98·2, but this figure is raised by the inclusion in the calculation of children brought from the district into the town to be vaccinated.

Bovine lymph depôts were maintained at Lucknow, Allahabad, and Bahraich, and, owing to an outbreak of small-pox in certain of the plains districts, a temporary depôt was opened at Naini Tal. The construction of the new central depôt at Patwa Dangar in the Naini Tal district was nearing completion.

Punjab.—The total number of vaccinations performed by all agencies in the Punjab in 1903-04 was 685,105 as compared with 667,544 in the preceding year. Of the total, 604,204 were primary operations, an increase of 21,578 on the total of 1902-03; but there was a further decline in revaccinations, which numbered only 80,901, or 4,017 less than in the preceding year. The increase in the number of primary operations shows that, in spite of the extended prevalence of plague, ground is being regained. The fall in the number of revacci-

nations it attributed by the provincial Sanitary Commissioner to the prevention of the revaccination of children who have been vaccinated or revaccinated only a few years before, and by the local Government to the lack of system on the part of vaccinators. The percentage of success in primary operations was 99·13, and in revaccinations 76·25, this considerable improvement on the results of the preceding year being in part at any rate due to the exclusion from the calculation of cases in which results were not known. Of the primary operations, 53 per cent. were performed on males and 47 per cent. on females (a proportion which happens to be almost exactly that of the distribution of the sexes in the total population), while of the revaccinations 62 per cent. were performed on males and only 38 per cent. upon females, because, it is explained, parents are reluctant to allow their young daughters to be seen by the vaccinators.

No town was brought under the Act during the year, but in most of the towns in which it is in force the work performed was satisfactory. In some towns no operations were performed on account of the severity of plague.

The numbers of primary operations and revaccinations performed in Patiala were 44,500 and 6,219, respectively; in Bahawalpur, 17,379 and 21; in Kapurthala, 5,699 and 40; in Faridkot, 4,913 and 1,401; and in Jhind, 4,751 and 1. The percentages of success ranged in primary cases from 99·50 in Patiala to 94·91 in Bahawalpur, and in revaccinations from 93·51 in Faridkot to 33·33 in Bahawalpur.

North-West Frontier Province.—The total number of vaccinations performed in the North-West Frontier Province, including the political agencies, was 99,176, an increase of 8,883 over the total of 1902-03, but the increase was due to a gratifying extension of the operations of the Department in Chitral where, small-pox being epidemic, no less than 28,353 vaccinations were performed; in the British districts, owing largely to the prevalence of sickness among children and illness of vaccinators, there was a great falling off. Primary operations numbered 94,262, nearly twelve thousand more than in the preceding season, but the number of revaccinations fell off by 3,027, success being at the rates of 91·52 and 79·91 per cent., against 93·54 and 69·84 in the previous season. The mean number of operations performed by each vaccinator was 2,609·90. In only two of the municipal towns, Bannu and Dera Ismail Khan, is the Vaccination Act in force, and the percentage of available children belonging to these towns who were vaccinated was 87·3.

Central Provinces and Berar.—The control of the Vaccination Department of Berar was transferred to the Sanitary Commissioner of the Central Provinces on the 1st November, 1903; as a consequence the arrangement under which in the Central Provinces Civil Surgeons are directly responsible for vaccination in their districts, was extended to Berar, and a scheme for the reorganisation of the combined department submitted to the local Administration.

The total number of operations performed in the Central Provinces, including the Feudatory States, during the year was 522,609, an increase of 58,558, which, in view of the wide distribution of plague, must be regarded as highly satisfactory. The percentage of success attained in 446,411 primary operations was 98·65, and in 76,198 revaccinations 87·74, against percentages of 97·13 and 85·14 in the same classes of cases in 1902-03.

In Berar, the number of operations fell from 141,064 to 123,696, but the percentage of success in primary operations which numbered 101,401, was 97·92 against 96·8 in 1902-03, although the rate of success in 22,295 revaccinations fell from 16·5 to 15·60. The decrease in the number of operations in Berar is attributed in part to the epidemic of plague and in part to the temporary breakdown of the depôt at Amraoti. The mean number of operations performed by each vaccinator was 1,815 in the Central Provinces and 3,255 in Berar. The difference in the degree of success claimed in revaccination in the Central Provinces and Berar is very striking, the percentages ranging in the former province from 100·0 in Saugor to 36·11 in Nimar, and in the latter from 23·90 in Buldana to 5·84 in Ellichpur. The cause of the difference is probably in part due to a higher standard being required in Berar, but the subject was under enquiry.

In the Central Provinces, 160,190 persons were vaccinated with fresh calf lymph and in 95·5 per cent. the operation was successful; 209,929 were vaccinated with glycerinated calf lymph with the same proportion of success; 1,076 were vaccinated

with lanolinated lymph, 92·6 per cent. successfully, and 32,669 with human lymph which gave the best results of all, 96·7 per cent. of success.

No new town was brought under the operation of the Vaccination Act, and in many of the municipalities vaccination is very backward.

Madras.—The total number of vaccinations performed by all agencies in Madras fell from 1,332,209 in 1902-03 to 1,309,985; primary operations falling from 1,250,762 to 1,240,655, and revaccinations from 81,447 to 69,330, the percentages of success in each class of operation being 89·02 and 68·95 in 1903-04, against 89·08 and 68·91 in 1902-03. The causes of the falling off, which occurred mainly in local fund areas, is stated to have been in various places the absence of small-pox, deficient and irregular supply of lymph, the prevalence of plague and absence of vaccinators. The number of operations performed by each vaccinator averaged 1,529.

Of the various lymphs in use during the year in primary operations the highest percentage of success, 98·5, was obtained with fresh calf lymph, followed by 96·9 with fresh calf lymph transferred for short distances in tubes and on plates. Lanolinated lymph from Bangalore gave a percentage of success of 95·0, whereas the locally prepared lanoline lymph succeeded in only 87·0, and glycerinated lymph in 86·9 per cent. For some reason the ratios of success in municipalities were higher than in local fund areas, in the former Bangalore lanolinated lymph succeeded at the rate of 96·5 per cent., locally prepared lanolinated lymph at the rate of 95·5 and locally prepared glycerinated lymph at the rate of 95·8. It is hoped that in the near future the full requirements of the Presidency will be derived from the King Institute at Guindy.

Coorg.—The total number of operations performed in Coorg fell from 11,407 in 1902-03 to 9,653. Of the total, 8,052 were primary operations, of which 93·47 per cent. were successful against 94·8 in the previous year; revaccinations succeeded at the rate of 79·13 against 80·4.

Bombay.—The number of operations in the Bombay Presidency in 1903-04 was 587,933, as compared with 578,885 in 1902-03, the increase being in the primary cases which rose from 537,744 to 552,101, while revaccinations declined from 41,141 to 35,832. The causes of the falling off are the presence of plague, the absence of epidemic small-pox, sickness or misbehaviour of vaccinators, &c. The percentage of success in primary operations was 92·51, and in revaccinations 55·02, as compared with percentages of 92·92 and 55·72 in 1902-03. Of the primary operations, 51·19 were performed on males, but of the revaccinations the percentage performed on males was 76·89, and on females only 23·11. The average number of operations performed by each vaccinator rose from 1,354 in 1902 to 1,377.

In the Presidency Circle practically only bovine lymph was used—fresh lymph apparently in most of the cases. In all registration districts except Gujarat, a proportion of the vaccination was performed with bovine lymph, but in the Presidency generally, human lymph continues to be used in the vast majority of the cases. A scheme for the establishment of a central depôt at Belgaum for the manufacture of preserved lymph for the whole Presidency is stated to have been under consideration.

Burma.—The total number of operations performed in Burma in 1903-04 was 412,564, an increase of 30,791 on the total of the previous year. The increase was almost entirely in primary operations, the number of which rose by 30,093 to a total of 384,722, but the percentages of success fell from 86·93 in primary operations to 84·98, and in revaccinations from 48·15 to 43·65. The mean number of operations performed by each vaccinator was 1,780 as compared with 1,739 in the previous year. The increase was pretty generally distributed throughout the province, except in the Mandalay division, in which there was a falling off in every district save Katha and in the Chin Hills. In municipalities, where the Vaccination Act is in force, 86·93 per cent. of the available infants were protected during the year. In Rangoon, where the amount of work done has greatly increased, 65 per cent. of the available infants were protected.

Lanoline lymph paste was supplied from the depôt at Meiktila, but results were not uniform, probably on account of varying skill on the part of vaccinators and to exposure of some consignments of lymph to the sun.

Ajmer-Merwara.—The number of operations performed in Ajmer-Merwara further increased from 12,992 in 1902-03 to 13,199 in 1903-04. Of the total, 13,111 were primary operations and 88 revaccinations, with success at the rates of 99·17 and 82·95 per cent. against 99·18 and 86·36 in 1902-03.

Civil Sanitary Works.

Bengal.—Excluding Calcutta and including the two new municipalities of Dumka and Nawabgunj, there were 159 municipalities in Bengal during 1902-03, as compared with 157 during the previous year. As, however, no statistics are available for the two new municipalities the figures below refer to the 157 municipalities which were in existence throughout the year 1902-03. Including an opening balance of £42,216 their total income amounted to £372,242, of which 43·01 per cent. was spent on sanitary works, original and recurring, 9·56 per cent. on roads, 5·40 per cent. on public safety, and 27·09 per cent. on all other requirements, the corresponding figures for 1901-02 having been 43·41, 9·89, 5·58, and 29·32, respectively.

The total expenditure on sanitary works amounted to £159,949 or 43·01 per cent. of income, as compared with an expenditure of £150,300, or 43·41 per cent. of income in the previous year. About £81,700 were spent on conservancy, over £23,700 on water-supply, over £10,000 on drainage, and nearly £33,300 under the heading of treatment of the sick. Compared with the previous year £7,739 more was spent on water-supply and £4,794 more on the treatment of the sick, while £1,334 less was spent on conservancy and £288 less on drainage. The increased expenditure on water-supply was chiefly due to large outlay by the municipalities of Darjeeling and Garden Reach. The new water-supply scheme for the former place is in progress, but has not yet been completed. The filtered water-supply from the Calcutta mains has been extended to the latter municipality, which is now being supplied daily with about 50,000 gallons of pure water. New dispensary buildings were constructed at Patna, Rampur Boalia, Jalpaiguri, and Serajganj, and the cost of these, together with £3,800 spent on the Bankipore hospital during the year, were mainly responsible for the increased expenditure under the heading of treatment of the sick. Only nine municipalities, or one less than in the previous year, spent over 10 per cent. of their income on original sanitary works, 20 against 17 spent between 5 and 10 per cent., 77 against 74 spent below 5 per cent., while 51 against 56 spent nothing on this account.

The total cost of various new works carried out by municipalities, district boards, Government, and private individuals, either completed or in progress, amounted in towns to £25,670 against £21,907 in the previous year, and in rural areas to £42,612 against £48,140. With the exception of the extension of the filtered water-supply from the Calcutta mains to the Garden Reach municipality, no new work of first class importance was either commenced or finished during the year.

The useful scheme inaugurated by the Patna Sadar Local Board for the improvement of sanitation in villages and rural towns continued to work satisfactorily, 112 villages being cleansed during 1902-03 by the Patna Sadar and Dinapore Local Boards at a cost of only £91. Under this scheme members of the Board report the names of villages in the vicinity of their places of abode which they find to be in an insanitary state. A list of such villages, together with an estimate for cleansing them, is then laid before the Local Board, and, when passed, cleansing operations are started under the supervision of a member of the Board. The work is carried out on a systematic plan and consists chiefly in the removal of filth and rank vegetation, and the filling up of ditches and hollows.

Four meetings of the Sanitary Board were held during the year and the usual consultation work was carried on by circulating the files to the members. The principal subjects discussed at the meetings of the Board were the efficiency of the septic tank system of sewage disposal and the question of the supply of filtered water to riparian municipalities from the mills within their jurisdiction. The provincial Sanitary Commissioner does not state whether any conclusions were arrived at as a result of these discussions. Preliminary estimates were prepared under the orders of the Board during the year for the supply of filtered water to the Barisal municipality and for the re-modelling of the Dacca water-works.

Detailed estimates of cost for the construction of septic tank latrines in the municipalities of Howrah, Dacca, Garden Reach, and Cossipore-Chitpur were prepared in the Board's office, and similar estimates of cost of the drainage schemes for the municipalities of Bihar and Uttarpara were prepared under the supervision of the Sanitary Engineer.

Plans and estimates were considered and opinions given regarding ten water-supply and drainage schemes, among them being certain improvements in connection with the Howrah water-works; a scheme for the supply of filtered water to the Titaghar municipality, the filtered water to be supplied by the owners of certain mills in the neighbourhood; similar schemes for the supply of filtered water to the Garulia and Bhatpara municipalities; and drainage schemes for Howrah, Rangpur, Barnagore and Naihati. The Board dealt also with a number of miscellaneous references made to them by Government and by local authorities. During the year the Sanitary Engineer inspected the water-works at Arrah, Bhagalpur, Burdwan, Berhampore, Dacca, Darjeeling, Howrah and Mymensingh, as also the drainage systems of Patna and Monghyr. In addition visits were made to Barisal, Buxar, Garden Reach, Baranagar and Sodepore either for the inspection of water-works, sanitary works or in connection with sewage disposal works.

During the year two Bachelor of Engineering students completed their term of practical training under the Sanitary Engineer and obtained certificates. Two other students with the same qualification have placed themselves under the Sanitary Engineer for training.

Assam.—Excluding four small towns which have no separate income, the total income of the municipalities, stations, unions, and towns in Assam during 1903 was £15,780, as compared with £14,530 in 1902. The expenditure on direct sanitation, which excludes £3,844 spent on roads and bridges, was £8,475, or 53 per cent. of the total income.

Under conservancy £4,864 was spent against £4,656 in 1902; under water-supply £1,286 against £1,836; under drainage £739 against £640, while the balance was spent on minor sanitary works (£1,406) and vaccination (£172). The proportion of income spent by local bodies on sanitation ranged from 85·78 per cent. in the Golaghat union, to 15·26 per cent. in the town of Lakhimpur. The principal sanitary improvements effected by local Boards in rural areas during the year were the construction and repair of tanks, wells, market-sheds and latrines, and the improvement of village sites.

No meeting of the Sanitary Board was held during the year. The provincial Sanitary Commissioner was consulted unofficially on all matters relating to sanitation, and during the touring season he inspected the sanitary condition of all head-quarter stations and nearly all sub-divisional towns, placing on record criticisms for guidance.

United Provinces.—No details regarding municipal or district board income, or of the expenditure on sanitation, are furnished in the provincial report. Many sanitary improvements in various directions were effected during the year under report, and the cost of the projects for improving the sanitary conditions of municipalities approved by the Sanitary Board amounted to £84,327, or 16 per cent. more than the corresponding figure in the previous year, and 75 per cent. more than in 1901. Projects for improving the drainage in Agra, Farrukhabad, Allahabad, Muzaffarnagar, Aligarh, Deoband, Mirzapur, Dehra Dun, Saharanpur, Fyzabad, Kosi, Pilibhit, Chandausi and Sitapur were either in progress or will be put in hand shortly. The work at Benares and Cawnpore is being carried on, while the important drainage scheme for Lucknow has now been started and is well in hand. The local Government has adopted, as part of their programme of plague prevention, an active sanitary policy, and in the spring of the year under review a grant of two lakhs of rupees was made for the general cleaning up and sanitary improvement of small municipalities and towns. A further grant of £4,000 was also made for the improvement of wells in the smaller centres of population, while the important sanatoria of Naini Tal and Mussoorie were assisted by allotments of £2,667 and £3,334, respectively, for the improvement of the general sanitary condition in the former station and that of the Landour bazaar in the latter. In addition to this the local Government proposes from 1904, to relieve municipalities of police charges to the extent of over three and a half lakhs and will grant one lakh for cleaning up certain towns and larger villages. The liberality of the local Government has

resulted in valuable work having been done already and is creating an interest in sanitation among the people.

The amounts of filtered water supplied per head of population in the towns in which water-works are in operation were as follows: at Benares over 15 gallons per head *per diem;* at Lucknow 5·5 gallons; at Cawnpore over 14 gallons; at Agra over 9 gallons; at Meerut over 4 gallons; at Dehra over 7 gallons; at Mussoorie over 6 gallons; and at Naini Tal 7 gallons. The results of analyses of the filtered water were, in nearly all cases, satisfactory.

Seven meetings of the Sanitary Board were held during the year, at which projects and estimates amounting to £84,327 for improving the sanitary condition of municipalities were considered, discussed, and approved. In connection with water-works the Board approved the plans and estimates amounting to £2,134 for the extension of the clear-water reservoir at Agra as well as other minor improvements in the water-works at Benares, Lucknow and Cawnpore. A project to cost £844 for improving the water-supply at Almora was also discussed. In all 27 drainage and sewerage schemes were considered and approved. Of these ten were in connexion with the surface drainage, latrines and sewers of Benares, the estimates for these schemes amount to £35,891. Other important drainage projects were those of Mirzapur (£21,630), Dehra Dun (£2,700), Kosi (£2,957) and Farrukhabad (£1,647). Plans and estimates for constructing slaughterhouses in Allahabad, Chandpur and Amroha were considered and approved, and among other miscellaneous works a project for constructing a vegetable market and a meat market at Bareilly (£4,370) received the Board's approval and recommendation for sanction.

Punjab:—No details of municipal income or of the expenditure on sanitary works are furnished by the Sanitary Commissioner of the Punjab in his report for the year under review.

The Sanitary Engineer gives, as usual, an interesting report of works in progress during the year. The Amritsar waterworks, estimated to cost £70,000, are well in hand, and of the forty wells to be sunk, twenty-two were completed to the full depth of 65 feet during the year. Five more were nearing completion and work on the remainder was well advanced. About two-thirds of the entire work of pipe-laying had been completed, and work on the city service reservoirs was progressing favourably. The construction of soil depôts in connexion with the Simla sewerage extension works, which are estimated to cost £34,575, was completed during the year, and the main system of new sewers on the south slope of the hill, leading to the Lalpani outfall, was in regular use throughout the year. Experiments in connexion with the biological treatment of sewage were continued. The septic tank at Lalpani continued to work satisfactorily, but the filter did not give good results. The Kasumpti experimental installation was brought into use in February. The septic tank did not work satisfactorily at first, but after the grit chambers had been reduced in length the results were better, and at the end of the year the tank was working fairly well. As at Lalpani the filters in this installation frequently become clogged and the effluent turbid and offensive. The effect of running septic tank effluent down a long flight of steps in order to thoroughly aërate it was tried. The steps were about eight inches each, and the total height of the flight was thirty-five feet. The effluent was deodorised to a considerable extent by this means, but analysis did not show any appreciable reduction of albumenoid ammonia or increase of nitrates. As the septic tanks have so far given good results it has been decided to install them at once at all the outfalls and to continue experiments with the filters. The Simla bazaar drainage works, estimated to cost £6,154, were completed during the year and have effected considerable sanitary improvement in the crowded bazaars of Simla. In connexion with the proposed extension of the Simla water-works, further information regarding sources of water-supply was collected and some surveys made. Umballa city suffered from shortness of water in the hot weather and works were commenced to augment the supply by adding four more wells to the head works. As the experimental aermotor pump at these works has worked satisfactorily the local Government has sanctioned the trial of two similar pumps at the new civil station of Mianwali. The extension of the trench wells for the Lahore water-works was completed during the year and the old wells were dredged and cleaned, thus substantially increasing the supply. The extension of the distribution system in the city and civil station at an estimated cost of £16,120 was proceeded with by the municipal committee and nearly completed.

Among the sanitary works under construction by the Public Works Department were the Lyallpur water-works, the estimated cost of which was £8,572, the Lyallpur drainage works estimated to cost £5,273, extramural drains for Umballa city estimated to cost £2,876, a sewer in Chandni Chowk at Delhi estimated to cost £1,722, the Toba Tek Singh drainage scheme estimated to cost £6,030, and the Gojra drainage scheme estimated to cost £4,160. All except the last of these works were completed, or nearly so, during the year under review. The experiment for raising water from a deep tube well by means of an air lift, referred to in last year's report, was carried through, but the result was not favourable, and tended to show that this method of raising water is not suitable for places where the subsoil consists of fine or moderately coarse sand.

Special efforts were made during the year to encourage the use of sewage at outfalls for land irrigation. The result in respect of sewage farms has not, so far, been encouraging, but a beginning has been made and success depends on the recognition given to the matter by local bodies.

The scheme for the grant of rewards and *khillats* to village communities to promote sanitation has not been attended with success. The Sanitary Commissioner himself is of opinion that small rewards are useless and that the payment of a sum of Rs. 500 into the *malba* fund of a village would possibly do more good.

Six meetings of the Sanitary Board were held during the year. The drainage schemes of Sangla, Sargoda, Ferozepore, Rawalpindi and Multan, as well as the water-supply scheme for Mianwali were considered and approved. The Board recommended to the municipal committee of Umballa that they should take up a piece of land for a sewage farm, and in connexion with the sewage disposal works at Simla they recommended the continuance of the filter experiments in the hope that they might throw light upon the method of disposal of the sewage at the Snowdon outfall. The land required for the sewage farms lies in State territory, and would have to be acquired by negotiations with the State authorities. Grants-in-aid for sanitary works were made to various local bodies out of the amount placed by the local Government at the disposal of the Board for this purpose, and the Board also allotted certain grants for experimental works at Umballa and Simla. The attention of the Board was also directed to the question of rewards to villages in the Chenab Colony for sanitary improvements and to other matters.

North-West Frontier Province.—The aggregate income in 1903 of the ten municipal towns and the Tank "notified area" in the North-West Frontier Province amounted to £46,470, the opening balance at the beginning of the year being £12,508. The expenditure on sanitary works was £9,236, equal to 19·8 per cent. of the income. It was incurred under the following main headings, the figures in brackets representing the expenditure under the same heading during 1902: conservancy establishment £4,472 (£4,461); paving £622 (£622); roads and bridges £458 (£1,022); drains and sewers £1,188 (£1,011); water-supply including cleaning wells and tanks £1,536 (£1,477); construction of latrines £142 (£76); repairs to latrines £22 (£32); widening streets £766 (£60).

The income derived from the sale of manure and street sweepings in all the municipal towns was £1,304 or £208 more than in 1902.

No new work of capital importance was undertaken during the year, but in Peshawar city the sum of £874 was spent on the extension of the water-supply, cleaning wells, and the maintenance of the water-works establishment, and the sum of £990 on the construction of new surface drains and the repair of old ones. In Kohat, in consequence of the limited quantity of pipe water available, it was possible to extend the supply only to the new slaughter-houses at Jarwanda and to Sangeri. In this town fair progress has been made of late years in the construction of town drains, and in 1903 the sum of £172 was spent on this account. In Dera Ismail Khan, Bannu, and other places in the province attention was paid to water-supply by the construction of new wells or water-cuts, and the cleaning out of old wells and tanks.

No rewards were paid or *khillats* given to village communities during the year for special interest taken in sanitary improvements, and, so far, no useful result is said to have followed the issue of sanitary note books to villages.

Central Provinces and Berar.—The sanitary administration of Berar was taken over by the Sanitary Commissioner of the Central Provinces on the 1st of November, 1903; and in future a single report on the combined area will be given.

In the Central Provinces the total income of head-quarter municipalities during 1902-1903, excluding opening balances and receipts under the heading of "Grants and Contributions for General and Special purposes" and "Extraordinary and Debt," amounted to £70,897, or £2,136 less than in the previous year. Of this sum 35·76 per cent. was spent on original and recurring sanitary works, 7·77 per cent. on medical relief, ·08 per cent. on vaccination, and 2·10 per cent. on other sanitary requirements.

In Berar the total income amounted to £12,367, of which 33·84 per cent. was spent on sanitary works, ·49 per cent. on vaccination and 3·07 per cent. on other sanitary requirements.

No new work of great importance was undertaken during the year, but in connexion with the Nagpur water-works a sum of £3,795 was expended in laying a duplicate rising main and in providing a new pump; the Nagpur drainage survey was also completed and the project prepared. Extensions of the water-supply service were made in connexion with the Bhandara, Harda, and Burhanpur water-works, and drainage surveys for Khandwa and Burhanpur have been completed. A number of minor works were carried out by municipalities chiefly in connexion with the improvement and extension of water-supplies and the construction and repair of drains. In the villages of the Central Provinces which are under the Village Sanitation Act, the chief expenditure was incurred under the headings of conservancy and clearing of village sites. The provincial Sanitary Commissioner considers it desirable that in all these villages a certain portion of the income should be devoted to improvement of the water-supply and of the drainage, and notes that in the districts of Bhandara and Wardha only does this appear to have been done to any appreciable extent. In comparison with the previous year considerable activity has been shown in sanitary matters in several head-quarter municipalities in the Central Provinces.

During the year a special grant of £1,667 was made by the local Government for the improvement of village water-supply in the Central Provinces. The money was allotted to villages in the Nagpur, Chhattisgarh, Jubbulpore and Nerbudda divisions, and the works as finally sanctioned were the construction of 95 new wells, the repair of 80 existing wells, and the construction and improvement of five tanks, at a total estimated cost of £3,000. It is expected that all these works will be completed before the onset of the rains of 1904.

During the year meetings of the Sanitary Board were held at the head-quarters of all districts in the Central Provinces, except Seoni and Nagpur. Steps have been taken to maintain in each district council's office a record of desirable works of village sanitary improvements as well as a register of all wells constructed in connexion with the district sanitary schemes, with a view to their being periodically inspected and kept in good repair. The work done under the direction of the Board was chiefly in connexion with the construction and repair of wells.

In Berar the meetings of the Sanitary Board have hitherto usually been held at district head-quarters during the rains. There is nothing in the nature of a district sanitary scheme and proposals for sanitary improvements have usually been made by the Sanitary Commissioner, the entire cost being debited to district funds. Apparently no local aid has ever been sought. In future the Civil Surgeons of Berar, like those of the Central Provinces, will go on tour during the cold weather in order that they may become acquainted with the sanitary needs of their districts.

Madras.—No details regarding income or expenditure of municipalities are furnished in the provincial report. The Cocanada water-works, the estimate for which amounted to £31,080, and the Vizagapatam water-works were both completed during the year and opened for public supply. The protective works to the head-works of the Trichinopoly water-works were also completed during the year and two additional infiltration wells for these works were sunk. Water-works for Coonoor, Guntur and Dindigul were in course of construction and good progress had been made with them by the end of the year. The construction of experimental filters for disposal of the sewage from the King Institute of Preventive Medicine at Guindy was completed by the Sanitary Engineer.

Schemes in connexion with water-supplies for Coimbatore, Gudiyattam, Nellore, Cuddapah, Ellore, Kodikanal, Masulipatam, Tiruvannamalai, Vellore and Saidapet were considered and dealt with, as well as schemes of drainage for Ootacamund, Anantapur, Madura, Mangalore, Srirangam and Salem.

The plans and estimates for 101 minor sanitary works, of which three were minor drainage works, 31 minor water-works, 29 hospitals, 20 markets, 10 slaughter-houses, 4 latrines, 1 incinerator and 3 improvements to roads and buildings, were checked and scrutinised by the Sanitary Engineer during the year.

Slow but steady improvement is being made in the conservancy of towns, and there is evidence that the utility of night-soil for agricultural purposes, notwithstanding caste prejudices, is year by year more fully recognised. Thus, during 1902-03 municipalities realized the sum of £2,806 from the disposal of rubbish and night-soil as compared with £2,788 in the previous year, and £1,518 during 1892-93. In Tanjore the net profit from sewage farming was £125, and in Madras City it amounted to £2,402. Modified filter trenches, to replace cesspools, have been introduced with success in Cuddalore, Palamcottah and Periyakulam.

The total income of District Boards during 1902-03 amounted to £643,817, of which, if the total income after meeting "plague charges" be regarded as that solely available, only 5·4 per cent. was spent on sanitation. The provincial Sanitary Commissioner is of opinion that the absence of new sanitary works carried out by district boards is partly due to a lack of officers with time to devote to suggesting and drawing up the main outlines of simple schemes, and in this respect improvement may be expected from the recent appointment by the local Government of District Health Officers of the Assistant Surgeon class.

During the year the Sanitary Board reviewed the schemes relating to 149 sanitary works, of which 50 were for municipalities, 94 for Local Fund Boards, 1 for the Collector of Madura, 1 for the Collector of Salem, 1 for the District Magistrate of Anantapur, and 2 for the Inspector-General of Prisons, the aggregate estimated cost of the schemes being £117,760.

The following were among the more important schemes reviewed:—

(1) The water-supplies of Vellore (£24,000), Yercaud (£4,947) and Kodaikanal (£4,150).
(2) The drainage of Madura (£43,826) and Ootacamund.
(3) Improvements in the sanitation of Ootacamund (£964).
(4) Hospitals at Nandyal (£3,667) and Bezwada (£3,904) and a dispensary at Tirukkattuppalli (£334).
(5) Improvements to the market at Coonoor (£12,467) and a general market at Calicut (£2,020).

Rules for the conduct of the business of the Board were revised and the effect will be to reduce the volume of work devolving on the Board and secure greater expedition in carrying out smaller schemes. In future the powers of sanction of local bodies will be up to £34 and schemes costing between £34 and £67 will be disposed of by the Sanitary Engineer without reference to the Sanitary Board.

Coorg.—Particulars regarding the income and expenditure on sanitation of the municipal towns or of the district boards are not given in the provincial report. The advent of plague directed special attention to sanitation throughout the province and gave rise to a total expenditure of £312, but apart from the permanent improvements effected by a portion of this outlay, no sanitary work of importance was carried out during the year.

No formal meeting of the Sanitary Board was held during the year, but the Commissioner and the Civil Surgeon met frequently to discuss the details of certain sanitary reforms carried out in Mercara and Virajendrapet.

Bombay.—Excluding the Presidency town there were 166 municipalities in Bombay during the year 1902-03; and their aggregate income amounted to £398,960. Out of this sum £106,042 were spent on improving water-supply, on drainage and on conservancy within municipal limits. Compared with the previous year there was a decrease of about 4 per cent. in income and an increase of about 12 per cent. in expenditure.

The ravages of plague have embarrassed the financial position of most municipalities and for want of funds many urgent schemes of water-supply and drainage have not been carried out. At Ahmedabad the extension of the drainage, estimated to cost about eleven lakhs of rupees, made good progress during the year. The Sanitary Engineers inspected the works twice during the year and advised regarding a site for the proposed sewage farm. The municipality of Karachi applied for permission to raise a loan for the extension of the drainage, estimated to cost about eleven and a half lakhs of rupees, and the Sanitary Engineers submitted a report upon the scheme.

The income of the local Boards during the year amounted to £326,463, of which £15,718 were spent on water-supply and drainage. As compared with the previous year the income of these Boards increased by £30,540, and the expenditure under the above heads by £4,974.

The Bombay Village Sanitation Act of 1889 was in force in 265 villages against 294 up to the end of last year, the decrease being due to the abolition of 37 non-working committees in the Poona collectorate.

Sanitary inspection books have been introduced into a large number of towns and villages, and in Broach they have been introduced throughout the district.

The Sanitary Board met once only during the year, when a number of minor questions were discussed and a recommendation was made that two surveyors should be appointed to work under the Sanitary Engineer for the purpose of preparing small projects for municipalities. The only important question referred for the opinion of the Board was that of the sanitary regulations to be adopted for the new suburbs of Bombay in the island of Salsette. The work of locating the proposed roads, open spaces, building sites, &c., of these suburbs is being carried out under the orders of the Collector, and the Sanitary Engineer visited the locality three times during the year.

The following were some of the schemes upon which the advice of the Sanitary Engineer was requested :—

(1) The water-supplies of Tatta, Poona, Sukkur, Bhiwndi, Karachi Jail and Ahmedabad;
(2) The drainage schemes of Sholapur and Malabar Hill;
(3) Sites for police lines at Poona, and for a jail at Nasik.

The experiments on the Manjri experimental sewage farm are being continued.

Burma.—The aggregate income of the 41 municipalities in Burma during 1903, including opening balances, amounted to £655,092 against £596,405 in the previous year. Of this sum 32 per cent. was spent on water-supply, 1 per cent. on drainage, 12 per cent. on conservancy and 9 per cent. on other sanitary works. On rural sanitation £10,665 were spent during 1903, as compared with £11,563 during 1902.

At Rangoon the Hlawga water-supply scheme, estimated to cost £261,062, is approaching completion, and it is anticipated that it will be in working order in March 1905. The present water-supply has been augmented by sinking artesian wells.

The Mandalay water-supply project which contemplated the sinking of wells on the " Smreker " system and pumping the water to a reservoir located on Mandalay hill, whence it was to be delivered in pipes by gravitation, has been completed, but it is stated that the cost is beyond the means of the Mandalay tax-payers; and a proposal is now under consideration for supplying water by means of artesian wells.

The water-supply scheme proposed for Akyab has made no advance, but the Sanitary Engineer reports that the survey has been completed and that the project is under preparation.

At Prome the drainage scheme is being carried out piece-meal as funds become available, and during 1903 £910 were spent on this account, about half the town being now provided with good masonry drains. A sum of £6,564 was expended during the year on the new water-works of this town.

The water-supply scheme for Moulmein is progressing steadily and it is hoped that the work will be completed before March 1905.

A small septic tank installation has recently been constructed at Maymyo, and an interesting report by Mr. Gabbet, Executive Engineer, on the working of the installation has been commended to the attention of all municipal bodies in Burma.

Two meetings of the Sanitary Board were held during the year. At the first meeting held at Rangoon, the Board considered and disposed of references forwarded by civil officers and municipalities asking for advice on sanitary questions and projects. Type designs for markets, slaughter-houses, latrines, and incinerators were also considered. At the second meeting held at Moulmein, proposals for a surface drainage scheme and for an underground sewage system for Moulmein town were considered. The proposal for a surface drainage scheme was approved, and the consideration of proposals for sewers postponed pending completion of the surface drains.

General Remarks.

Red Sea Pilgrim Traffic.—For the pilgrim season of 1902-03 the Government of India announced that on their representation, His Majesty's Government had consented to remove the restrictions with regard to pilgrimage to the Hejaz which, in consequence of the continued prevalence of plague in India, had been in force during the past four seasons. In announcing the change of policy it was explained that the restrictions imposed on the liberty of His Majesty's Muhammadan subjects had at no time been agreeable to the Government of India, but had been rendered necessary in consequence of the apprehensions of certain European Powers that plague might be conveyed to Europe by Indian pilgrims. The previous orders were cancelled, and it was prescribed that no person should be permitted to embark with the object of making a pilgrimage to Mecca except at the ports of Bombay and Karachi in the Bombay Presidency, at Chittagong in the province of Bengal or at some one port in Madras which would be notified by the local Government of that Presidency. It was subsequently decided that a port should not be opened in Madras for the departure of pilgrims and that all Southern India pilgrims should be assembled in the Bombay Central Camp. All intending pilgrims were to be kept under observation until all risk of their carrying plague infection was over, and they were then to be conveyed from the place of observation to the port of embarkation. No passage tickets for the Hejaz were to be sold except at the places at which the pilgrims were detained under observation. Notwithstanding the removal of all restrictions as regards departure from India intending pilgrims were again advised, in view of the inconvenience likely to be experienced by them in Arabia, to defer their visit to another season.

According to the report on the Camaran Lazaret for the year 1902-03, twelve steamers conveying in all 5,125 pilgrims arrived from India. Four steamers sailed from Chittagong with 1,902 pilgrims, seven from Bombay with 3,042 pilgrims and one from Karachi with 181 pilgrims. All the vessels arrived at Camaran between the 24th of December, 1902, and the 18th of February, 1903.

The total number of deaths among Indian pilgrims at sea en route to Camaran was 15, the principal causes of death being malarial fevers, general debility and old age. During the period of detention at Camaran three deaths among British Indians are reported to have occurred, but no infectious disease made its appearance on the island.

Both before commencing the period of ten days' quarantine at Camaran and at the termination of that period the Indian pilgrims were this year required to undergo disinfection. The second disinfection is, in the British Vice-Consul's opinion, unnecessary and entails great hardship.

The Haj fell on the 9th of March, 1903; the weather was favourable and the general health good. Towards the end of April a few cases of small-pox occurred, but only one Indian pilgrim was attacked. Special sanitary measures appear to have been taken, and the sanitary condition of Mecca was greatly improved as compared with previous years.

All the pilgrims from India, irrespective of the port from which they had embarked, returned to Bombay. They were conveyed in 13 vessels which arrived between the 5th of April and the 20th of June, 1903. During the journey by sea nine deaths, one of which was due to small-pox, occurred. Four of the steamers arrived at Bombay with cases of small-pox (seven in all) on board. In accordance with the usual practice, pilgrims whose homes were up-country or beyond the frontier were not allowed to enter Bombay town but were despatched by rail direct from the landing sheds to their homes. The effects of all pilgrims were disinfected after disembarkation.

The improvidence of pilgrims from India is evidenced by the fact that in May between 200 and 300 were destitute, and a large number had no money to pay for their return journey to India. The British Vice-Consul at Jeddah induced the Bombay and Persia Steam Navigation Company to convey 356 destitute pilgrims to India without payment and 150 at Rs. 5 each, the Consulate providing food for the journey out of the Indian Pilgrim Relief Fund.

With regard to the payment of sanitary dues levied at Camaran, it may be noted that this season 30 per cent. of the Indian pilgrims paid their fees in gold and benefited accordingly.

Malaria.—In these reports for the years 1901 and 1902 summaries were given of the experiments in mosquito destruction carried on at Mian Mir by Captain James and Lieutenant Christophers. Since the full accounts of the work done by these officers were published the experiments have been the subject of many criticisms, some of them favourable and some of them unfavourable. Of the unfavourable criticisms some are just and will be useful in respect of the conduct of future experiments, but some can have been made only in forgetfulness of the state of knowledge when the experiments were initiated, and very many seem to be founded upon a misconception of their intention and scope. In the somewhat scanty accounts of other experiments of a similar nature, we find that anti-mosquito operations involving, at the most, inconsiderable engineering works were carried out with the immediate result of producing an astonishing diminution of the incidence of malarial fevers in the locality—as gauged by the entries in dispensary books; but in some cases it would appear that, before the anti-mosquito operations, malarial fevers were diagnosed from clinical symptoms, and, after the operations, by the use of the microscope. When a change of this sort is made in the method of diagnosis in India, equally astonishing results ensue, apart altogether from any anti-malarial measures.

At Mian Mir the main operations were directed against mosquitoes and an attempt was made to ascertain the degree to which their multiplication could be limited by such proceedings as are within the compass of a mosquito brigade. In the present state of our knowledge it must be obvious to any one that, if mosquitoes can be exterminated in an area, this is the best way to get rid of malaria; the use of mosquito curtains and quinine, however valuable in individual prophylaxis, being merely palliative in the case of a community. The experiments showed that in such a cantonment as Mian Mir mosquito destruction is beyond the powers of a mosquito brigade, and it becomes a problem what is the best method, or combination of methods, to suppress the disease in such a place. The first question is, what engineering works and what restriction of cultivation will bring mosquito destruction within the powers of a mosquito brigade; and the second, what will be the cost of the engineering works and of the restriction of cultivation in money and in the amenities of life. If the cost in either direction is excessive, it has to be decided whether it would not be well, in the first instance, to try the effect of removing bazaars and houses inhabited by native children to a distance from barracks, treating with quinine all native children found to be infected, preventing the breeding of mosquitoes within, say, two hundred yards from barracks, the issue of mosquito-curtains to the men, and the prophylactic use of quinine. If all those measures fail and the abandonment of the cantonment is out of the question, then we must fall back upon great drainage works and restrict cultivation to the limit which will render the extirpation of mosquitoes possible without rendering the cantonment uninhabitable by man. Where, on the other hand, ample funds and labour are available, and where it is considered that the probable reduction in the amount of malaria will sufficiently compensate for any disadvantages, economic or other, which can scarcely be avoided, it is doubtless preferable to commence forthwith extensive works of surface drainage and the filling up of all hollows and surface inequalities with the object of preventing the breeding of mosquitoes.

The question is finally one of cost and convenience, and where the local circumstances vary so greatly each problem must be judged on its merits, for the method which may succeed in one place may fail completely elsewhere.

In the case of Mian Mir the military authorities have decided to adopt the latter of the two courses mentioned above. In a special order lately issued by the General Officer Commanding the Lahore Division it is stated that in Mian Mir the following measures will be carried out:—(1) closing of canal irrigation; (2) levelling in of all hollows; (3) surface drainage; (4) removal of jungle grass and bush; (5) proper disposal of water used for washing or otherwise polluted; (6) proper disposal of refuse; (7) sanitation of cook-houses; (8) sanitation of servants' houses; (9) sanitation and reduction of extent of various bazaars. With reference to the first and second of these measures it has been decided that the filling in of canal cuts and the levelling of hollows made for building lines shall be carried out as a military fatigue duty. The results of this experiment will be watched with great interest.

When it was found that mosquito destruction by simple measures was impossible in Mian Mir, Captain James was placed on special duty to visit other malarious contonments with a view to further experiments. During 1904 the cantonments of Delhi Fort, Meerut, Allahabad Fort and Fatehgarh were examined by Captain James

with the following results. Delhi Fort was visited in April and again in August. In the former month larvæ of anopheles were found in many pools and reservoirs of water in the grounds of the fort, but no adult insects could be found in the barracks, and new infections had not commenced among the troops. In August the number of breeding places had increased very greatly. Building operations were going on in the fort grounds, and numerous pools of water, in all of which anopheles larvæ were abundantly present, had formed near the barracks. Larvæ were also found in the Selimgarh channel, which runs just outside the wall of the fort. Adult anopheles were very numerous in the barracks and the troops were beginning to suffer severely from malarial fever. Early in the month 53 per cent. of the native children under 10 years of age living in the fort were found to have malarial parasites in their blood. The breeding places in the grounds of the fort itself are so numerous that to deal with them effectively would be a task of some difficulty; but, even if they could be done away with, there would still remain on one side, within 50 yards, the dangerous Selimgarh channel, and, within 300 yards, the river; on another, in close proximity to the fort, the native town of Delhi; and on a third, at a distance of about 1,000 yards, the lines of the native infantry. In view of the proximity of these extensive sources of anopheles, Captain James considers that an attempt to rid the fort of malaria-carrying mosquitoes by efforts directed only against the breeding places in the grounds of the fort itself would not be successful, and that to deal with the sources outside the fort is impracticable. He believes that the troops in Delhi Fort would willingly use mosquito curtains if they were provided with them, and that this measure is the best practical means of combating malaria in this fort.

The cantonment of Meerut was visited at the end of August. Like Mian Mir it extends over a wide area, and experimental operations would be best confined to the lines of one regiment. The three British units are located at some distance from one another, and, as in Mian Mir, if operations were carried out in one series of lines, control observations could be made in the others. A preliminary malarial survey was made in the lines of the British cavalry. At first sight these lines would seem to be well adapted for anti-mosquito operations for there is no irrigation in their immediate vicinity and apparently they are well drained. There is, however, no lack of anopheles, and numerous breeding places containing larvæ were present in the lines at the time of examination, and many adult insects were found in the barracks and harness rooms. Two classes of breeding places in the lines would be very difficult to deal with, viz.: (1) eight very large ponds, and (2) a deep drainage channel called the Abu nullah which runs along one side of the lines between the barracks and the village occupied by the syces. Numerous anopheles larvæ were found in the running water of this nullah and it is probably the chief breeding place of the malaria-carrying species. There is another feature which would probably prevent anti-mosquito measures carried out in these lines from being successful. Although on three sides of the lines there are extensive spaces of waste land, the fourth is in direct communication, by means of numerous bungalows, with the large cavalry bazaar. To deal with all the breeding places in the compounds of these bungalows, in the bazaar, and to a sufficient distance beyond it, would be a very difficult task. At the time of examination 25 per cent. of the children in this bazaar were infected with malarial parasites, but it is possible that, as in Mian Mir, the endemic index would rise rapidly in October. In the syce lines only 15 per cent. of the young children were infected with malarial parasites at the end of August, and, while this cantonment is not so malarious as Mian Mir, the season during which new infections occur is even shorter than in that cantonment—at most lasting from the beginning of September until about the middle of November. The outlook for the success of anti-mosquito measures is certainly more hopeful in Meerut than in Mian Mir, but in view of the difficulties already mentioned, and the fact that protection from malarial infection would be required for about two and a half months of the year only, there is reason to suppose that the disease could be combated more easily and probably more successfully by other methods.

Allahabad Fort was visited in the beginning of September. It is well drained and throughout the area inside the walls only two collections of water could be found. Both were the result of leakage from standpipes, and both contained numerous anopheles larvæ. One of the large cemented reservoirs in the arsenal grounds also contained numerous larvæ, but these reservoirs, as well as all other breeding places inside the fort, could be easily dealt with. Outside the fort there is, on the one side, the River Jumna, and on the others a broad open plain through which the railway runs.

At the time of inspection the river was in flood and could not be examined for larvæ, but it is probable that at times when it is low, numerous breeding places would be formed along its banks. The ground on the other side of the fort is much broken and interspersed with numerous holes, small tanks and ditches. Most of these were full of water and contained numerous anopheles larvæ. It is doubtful whether any of the breeding places outside the fort could be effectually dealt with, but the main objection to the initiation of an experiment against mosquitoes in Allahabad Fort is the fact that it appears to be only very slightly, if at all, malarious. There is no source in the immediate neighbourhood from which anopheles could become infected. Only ten native children were living in the fort at the time of inspection; all were examined but not one had an enlarged spleen and malarial parasites were not found in the blood of any. The village of Kydgunj, situated about one mile from the fort, is the nearest inhabited area. Twenty-five native children in this village were examined, but malarial parasites were not found in the blood of any, and not one had an enlarged spleen. It must be assumed, therefore, that new infections with malarial parasites occurring among people resident in the fort are derived, through the agency of mosquitoes, from relapsing cases occurring among the troops. And this is very probable, for it frequently happens that the troops who garrison Allahabad Fort have previously been stationed in Delhi, and that a large proportion are more or less saturated with malaria on their arrival in Allahabad. In 1903, for example, out of 51 recorded admissions and re-admissions for malarial fevers, 24 were among men of the 75th Company, Royal Garrison Artillery, who had arrived from Delhi in November, 1902. In the medical officer's opinion most of the remaining cases would have been more correctly returned under the heading of "simple continued fever" than under that of "ague." Having regard to these facts and to the difficulties of dealing with the breeding places of mosquitoes outside the fort, Captain James is of opinion that malaria will be best combated in Allahabad Fort by the administration of quinine to all men who have come from malarious stations, and by the use of mosquito curtains in the hospital and barracks.

Fatehgarh was the last place examined during the year. This station also appeared to be only very slightly, if at all, malarious. In the bazaar which is situated in the centre of the lines, 30 native children under 10 years of age were examined, but not one of them had an enlarged spleen and in no case were malarial parasites found. Apart from this fact, however, the ground upon which the cantonment stands is so broken and so full of ditches and holes that a crusade against mosquitoes could not be undertaken except at great expense. A kutcha water channel of considerable width and depth, receiving tributaries from all parts of the cantonment area, runs through the lines to the Ganges River. To deal with it alone would be an engineering work of some magnitude, and so many other ditches and large holes exist in the area that experimental anti-mosquito measures would be useless. A large number of the admissions for malarial fevers recorded in this station are undoubtedly relapses of infections contracted elsewhere, the unusually hard work necessitated during the training in the mounted infantry classes being a powerful contributing factor. The composition of the force in this cantonment is, moreover, such as to prevent a comparison of the statistics of sickness during one year with those of another being of value, for it is made up of detachments from three regiments stationed in different parts of India, and each detachment remains only three months.

An important parasite recently discovered in man.—A special feature of research during the present year has been the elucidation of facts regarding a hitherto entirely unknown parasite of man and the differentiation of the morbid conditions to which it gives rise. In last year's report brief reference was made to this important parasite, and the résumé of our knowledge on the subject given in that report may conveniently be amplified and brought up to date here.

The first reference in literature, which can be said to relate to this parasite, is contained in an article written in 1885 by Cunningham, who, in describing the pathological appearances of sections made from the tissues of a "Delhi boil," drew attention to the presence in the tissues of certain cells containing darkly staining bodies. At that time neither the examination of smears made from fresh tissues nor Romanowski's stain were in use, and therefore it is not surprising that Cunningham did not observe in the bodies the characteristic structure which has since been revealed by modern methods of chromatin staining. In 1891, Firth showed that the parasitic nature of the cells discovered by Cunningham was fully recognised by

naming them "sporozoa furunculosa," but from the date of his paper until 1903 no further mention of the parasite occurred. In February of that year Marchand described, before the Medical Society of Leipsic, certain curious ring-like bodies included in large cells in the bone marrow from a case of Banti's disease, but whilst hinting at the possibly parasitic nature of the bodies, he came to the conclusion that they were, in reality, the products of nuclear changes. In May, 1903, Leishman described certain bodies, each possessing two very characteristic chromatin masses, found by him in 1900 in smears from the spleen of a case of Dum Dum fever. He believed them to be parasitic in nature, and, studying material taken postmortem, often some time after death, and chiefly concerned with the appearance of the chromatin masses, he came to the conclusion that the bodies were trypanosomes which had become altered by the death of the host or by the action of cells during life. This view of the nature of the bodies was dispelled by Donovan, who, using material taken by spleen puncture during life, was the first to suspect that the bodies were a form of parasite as yet undescribed. Donovan forwarded specimens to both Ross and Laveran, and it was chiefly from the descriptions published by these two observers that the scientific world first realized the high interest and great importance of the discovery. Laveran and Mesnil boldly announced that the bodies were a hitherto undiscovered human parasite and gave a description of the appearances seen in films of splenic blood to which no material addition has since been made. They found forms included in a substance which they took to be the body of a red blood corpuscle altered by the presence of the parasite, as well as forms which were distinctly pear-shaped, and forms divided into two or more by a process of fission, and they finally came to the conclusion that the parasite was a new species of *Piroplasma*. Ross also published, in two notes, an accurate description of the appearances of blood drawn from the spleen. He drew attention especially to the substance in which the bodies were embedded, and, discarding the view that it was the altered substance of a red cell, he termed it merely a matrix, but stated his opinion that it was, in all probability, an integral part of the parasite, possibly fragments of a parent mass. For some time interest chiefly centred in the nature of this matrix, and in addition to the two views given above, Manson and Low gave it as their opinion that this substance was, in some cases at least, a secretion thrown out by the bodies themselves. The most probable hypothesis was that, finally given by Christophers, who, comparing the appearances seen in films of splenic blood with those in sections of the viscera, came to the conclusion that the matrix was merely the fragmented cytoplasm of the splenic cells in which the great majority of the parasites are, under natural circumstances, included. Whilst discussion was rife as to the nature of the parasite important facts were coming to light in regard to the clinical and pathological conditions to which it gave rise. For many years it had been recognised that in some cases of so-called "chronic malarial cachexia" a disease existed which by no means conformed to the ordinary type of malarial infection, and in which several observers had consistently failed to demonstrate malarial parasites in the peripheral blood. It was also extremely resistant to treatment, and was largely responsible for the high death-rate ascribed to malaria in India. This disease indeed was so prevalent as to give to the fever cases in the hospitals of Calcutta and Madras a distinctive character, which was very puzzling so long as it was thought to be a manifestation of malaria. It was not long after the discovery of the bodies before it was generally recognised that these anomalous cases of fever were those of infection by the new parasite and had no relation to malaria. Cases of the disease were also reported from China, Egypt, Arabia, South Africa and elsewhere, and it became evident that the parasite was the cause of one of the commonest, most widespread and important of tropical affections. A new point of interest arose in connection with *kala azar*. In December, 1903, Donovan stated his belief that the disease seen by him in Madras was identical with *kala azar*, a surmise strengthened by the examination of material sent to him by Bentley and afterwards fully confirmed by Rogers, who left no doubt that *kala azar*, Dum Dum fever and some cases of so-called malarial cachexia were one and the same disease.* Throughout all these researches the attention of workers had been entirely directed towards the relation of the parasite to the blood and to its presence

* As was to be expected there has been a tendency of late to regard *all* cases formerly diagnosed in India as "malarial cachexia with enlargement of the spleen" as being due to the newly discovered parasite. The recent work carried out in the Punjab by Captain James shows that this is not the case, and that true malaria cachexia must still be regarded as a disease of great importance in India.

in the liver and spleen. An entirely new aspect was therefore opened up when Wright discovered bodies very similar to those present in certain cases of enlarged spleen, in the tissues of an Oriental or Delhi Sore, and James, comparing the parasites obtained from cases of splenic enlargement with those from Oriental Sores, left no doubt that in appearance, at any rate, they were identical.

Wright defined Oriental Sore, as Cunningham and others before him had done, as a focal granuloma of the skin, and he described and figured as the essential condition, a large mass of granulation tissue composed of cells which were, for the most part, crowded with the protozoan bodies and were strongly reminiscent of the lepra cells in a leprosy tubercle. His work clearly demonstrated that in Oriental Sore the organism is present in a rôle entirely different to that of a blood parasite.

The significance of Wright's discovery was not at first clear, and the association of two such dissimilar diseases as splenomegaly and tropical ulcer gave rise to considerable bewilderment. The relationship of the two conditions became clearer as research proceeded. In some cases of splenomegaly the bodies were found by Donovan in small ulcers about the knees and elbows, whilst Christophers demonstrated their presence in the granulation tissue of intestinal ulcers and showed not only that the bodies occurred in the spleen, liver and bone-marrow, in ulcers and granulation tissue of the intestine, in papules and ulcers of the skin, in the testis, lungs, kidneys and lymphatic glands of the groin, but also that they were, in practically every case, included in the cytoplasm of cells, a fact later confirmed by Manson and Low who also independently found the bodies in lymphatic glands of the mesentery. In addition Christophers pointed out that the cells which the bodies occupied were chiefly endothelial cells of the capillaries and minute vessels of the viscera and granulation tissue, thus demonstrating a type of endothelial invasion. Whilst the infective processes and relations of the parasite to the tissues of the host were thus being gradually shown to involve much wider principles than had hitherto been suspected, interesting developments were taking place in regard to its zoological characters. In spite of the evidence against the trypansome nature of the bodies, the startling resemblance of the double chromatin masses to the centrosome and nucleus of the *Trypanosomata* has kept research continuously applied to the question of their relationship to this still far from worked out group. The publication by Schaudinn of a paper of almost revolutionary character still further concentrated attention upon this point. Among many items of protozoan development, Schaudinn described that of a halteridium of the stone-owl in the alimentary canal of a "culex" mosquito, and influenced by analogy, it was suggested by several observers that the newly discovered parasite probably went through a trypanosome stage. This suggestion has possibly received confirmation in some recent work by Rogers, who reports that by keeping blood containing the parasites for two or three days in a solution of citrate of sodium at a temperature of 22° C., he has succeeded in observing the development of the parasites into trypanosome-like forms.

Thus our knowledge of this parasite, gained in a period of about two years, has left its zoological position almost as uncertain as when it was first discovered. Whether the parasite has a real relation to the pathogenic trypanosomata of mammals or whether it merely passes through a flagellate stage, we cannot yet assert. The fact that Laveran still believes that the organism is a *Piroplasma* shows how inconclusive is the evidence for its inclusion in any of the orders or even classes of the Protozoa at present recognized.

As regards the infective process in man our knowledge had advanced considerably. The establishment of the fact of a granulomatous lesion and of an infective endothelial invasion by a protozoan is important, and the fact that probably the same protozoan is concerned, leads one to suspect that, just as there may be an invasion of the lung, of the skin, of the lymphatics, or even of the bloodstream, by a bacillus, so there may be by certain protozoans. The study of the disease in man has also brought into prominence the necessity for the examination of other tissues than the blood, especially of the great store viscera of the body and the lymphatic glands. It has also given some very suggestive clues in the study of splenic anæmias, and it has greatly simplified many problems in connection with malaria.

Of the method by which the disease is conveyed we know nothing, and the generally supposed absence of the parasite in the peripheral blood has led Manson and Low to suggest the fæces as a possible means of exit from the body. In this connection the observation of Christophers that the bodies are often present in the leucocytes of the peripheral blood, especially in advanced cases, is important and

the possibility of a blood-sucking carrier should not be lost sight of. Observations upon the conditions under which the disease is contracted are much needed in order to give some more certain foundation for experimental research in this very important matter.*

Further researches upon this parasite.—Since the above was written, a report has been received from Lieutenant S. R. Christophers, I.M.S., containing an account of some researches carried out by him in connection with the development undergone by the parasites when kept at a low temperature in a solution of citrate of sodium. It will be remembered that, at the recent meeting of the British Medical Association, Captain Leonard Rogers, I.M.S., announced that by adding blood obtained by splenic puncture from cases of enlarged spleen caused by the parasites to a small quantity of sterile citrate of sodium solution, and keeping it at a temperature of 22° C. for two or three days, he had succeeded in observing the development of the parasites into trypanosomes. He found that when the citrated splenic blood was kept at blood heat the parasites very quickly disappeared, but that when kept in a cold incubator at 27° C. they retained their usual shape and characters for several days. Moreover, they increased markedly in numbers, and very numerous dividing forms were present. At a temperature of 27° C., however, the parasites lived for only three or four days, and he therefore reduced the temperature of the incubator to 22° C. This temperature was found to be most suitable for the development of the parasites, and he reported that in the cultures obtained from two cases "unmistakeable trypanosoma" appeared, together with smaller pear-shaped flagellated bodies and other intermediate forms. "The most marked of the cases showed completely developed trypanosoma with thick flagella macro-nucleus, and micro-nucleus, after incubation for one day, while the living forms were also seen in the blood culture, moving rapidly among the corpuscles." . . . "The other case in which the trypanosoma have developed was a case of *kala azar* from Assam, and after incubating for five days at 22° C. we found in the citrated blood a number of intermediate forms and a few fully-developed trypanosoma."†

While there could be no doubt that Captain Rogers had made a most important discovery regarding the development of the parasites outside the human body, it was apparent from an examination of the illustrations attached to his article that the bodies which he regarded as fully-developed trypanosomes differed considerably from ordinary trypanosomes met with in animals. They possessed no undulating membrane, the micro-nucleus or centrosome was situated at the end of the parasite from which the flagellum emerged instead of at the opposite end as in ordinary trypanosomes, and the flagellum appeared to pass out of the parasite directly from the micro-nucleus instead of being continued along the whole length of the body of the parasite.

---

* The following articles have been referred to in compiling this account:—Cunningham in Scientific Memoirs by Medical Officers of the Army of India, Part I., 1885; Firth in B. M. J. of the 10th January, 1891, page 60; Marchand, *Zur Kentniss der Sogen Bantischen Krankheit und der Anaemia Splenica*, in M. M. W., No. 11, 1903; Leishman in B. M. J. of the 30th May, 1903, page 1252; Donovan in B. M. J. of the 11th July, 1903, page 79; Laveran and Mesnil in *Bulletin de l'Academie de Medicine*, Séance du 3 Novembre 1903, page 238, Tome L; Ross in B. M. J. of 21st November, 1903, page 1376; Donovan in B. M. J. of 28th November, 1903, page 1401; Ross in B. M. J. of 28th November, 1903, page 1401; Donovan in I. M. G. of December, 1903; Laveran and Mesnil, *Sur un Protozoaie nouveau Piroplasma Donovani* (Lav. and Mesn.), *parasite d'une fièvre de l'Inde, Compt. rend des Séances de l'Academie des Sciences*, Tome CXXXVII., page 957, Séance du 7 Decembre, 1903; Wright in Journal of Medical Research, Volume X., No. 3, page 472, December, 1903; Bentley in B. M. J. of 16th January, 1904, page 160; Ross in B. M. J. of 16th January, 1904, page 160; Marchand and Ledingham in L. of 16th January, 1904, page 149; Manson and Low in B. M. J. of 23rd January, 1904, page 183; Laveran and Mesnil in *Compt. rend des Séances de l'Academie des Sciences*, Tome CXXXVIII., page 187, Séance du 25 Janvier, 1904; Leishman in B. M. J. of 6th February, 1904, page 303; Christophers in Scientific Memoirs by Officers of the Medical and Sanitary Departments of the Government of India (New Series), No. 8, February, 1904; Marchand and Ledingham in C. B. XXX., page 594; Donovan in I. M. G., March, 1904; Bentley in I. M. G., March, 1904; Rogers in I. M. G., April, 1904; Rogers in B. M. J. of 28th May, 1904, page 1249; Manson and Low in B. M. J. of 28th May, 1904, page 1257; Neave in B. M. J. of 28th May, 1904, page 1252; Marchand and Ledingham in Z. H., May, 1904; Manson and Low in B. M. J. of 2nd July, 1904, page 71; Rogers in L. of 23rd July, 1904; Rogers, Leishman, Donovan, Christophers, Castellani, Bentley, Phillips, Proceedings of the Section of Tropical Diseases of the British Medical Association, reported in B. M. J. of 27th July, 1904; Donovan in the Annual Report of the Government General Hospital, Madras, for 1903; Christophers in Scientific Memoirs by Officers of the Medical and Sanitary Departments of the Government of India (New Series), No. 11, 1904.

† British Medical Journal, 17th September, 1904, page 648.

Lieutenant Christophers reports that, influenced by the discovery of Captain Rogers, he has kept blood obtained by splenic puncture from suitable cases under the necessary conditions, and has succeeded in observing a development of the parasites resulting in a great increase in numbers and the formation of flagellate forms. The following is a brief summary of the results obtained by Lieutenant Christophers in one of his cases. About 1 c.c. of blood was removed from the spleen of a case having a greatly enlarged spleen and a high, but irregular temperature. Parasites were fairly numerous in a film made at the time of puncture. The blood was kept in a very small quantity of citrate of sodium solution at a temperature varying between 22° C. and 24° C. On the third day a number of the bodies were unchanged in appearance, but a very few were seen in which the protoplasm was increased in amount and was stained a dark blue. On the fourth day the large forms with darkly staining protoplasm were very conspicuous. As a rule they were circular in shape and the two chromatin masses were not so markedly at the periphery as in parasites seen in blood taken directly from the spleen. On the fifth day still larger forms were seen. The majority were as large or larger than a red blood corpuscle, measuring as much as eight micromillimetres in diameter. Their protoplasm was granular and stained distinctly blue. The large chromatin mass had increased in size and its substance was arranged in the form of numerous granules. The small chromatin mass, though slightly enlarged, retained its original shape and appearance. Many of the large forms were seen in various stages of fission and groups of two and of four forms were more numerous than single bodies. In addition, considerably elongated parasites, having the small chromatin mass or centrosome at one end, were present. In some of the forms a new structure, consisting of a circular vacuolic pink-staining area, was apparent, and by careful focussing an appearance resembling a coiled thread could sometimes be made out. The contents of some of the vacuolic areas appeared to have been extruded from the parasites and masses of pink staining material showing the same shade of colour were frequently seen lying outside the body of the parasite near the extremity occupied by the centrosome. In a few cases delicate faintly stained irregular flagella-like filaments were seen to be continuous with partially extruded pink substance. On the sixth day the bodies were almost invariably in groups of from four to ten, the individual bodies being rarely of less size than a red blood cell. Pear-shaped forms were the most frequent, the large end containing the nucleus, while the thin end contained the centrosome. The thin ends of the pear-shaped bodies invariably lay close together attached to an indistinctly stained irregular mass forming the centre of the group. The thick ends projected in a characteristic way. Many of the bodies possessed a short, thick, clearly outlined, flagellum, the terminal extremity of which was distinctly thickened or clubbed. In many instances the flagellum could be clearly seen entering the body of the parasite. In some cases it appeared to arise directly from the centrosome, but in most a short gap intervened. Its length was in some cases at least fifteen micromillimetres. A certain number of forms were more elongated, but though they were of considerable length and tenuity no tendency of the flagellum to pass backwards towards the nucleus was observed. In a number of instances the bodies appeared to have developed and subdivided while still included in the cytoplasm of a cell. On the seventh day groups of many forms were most commonly encountered, several bodies in each group showing long flagella. Fission appeared to be in active progress and the central gelatinous-like mass was very voluminous. On the ninth day single forms were rare and closely aggregated masses of the bodies were almost exclusively seen. On the twelfth day subdivision had progressed still further. Individual forms were often diminished in size and it was often difficult to trace their outlines and to assign the chromatin masses to their respective parasites. The formation of flagella was a constant feature though it occurred in only a limited number of parasites in each group. No sign of degenerative changes or of a diminution in the number of groups had occurred and fission in an irregular way was still in active progress. Throughout the examinations no forms resembling adult trypanosomes were seen and the flagellum in every case, even in the very elongated forms, passed directly outwards from the centrosome.

Lieutenant Christophers considers that the most advanced forms seen by him are not essentially different from the most advanced forms seen by Captain Rogers, but he does not feel justified in stating that they are fully developed trypanosomes. He remarks that although in his own specimens and in the drawings illustrating Captain Rogers' article there are forms resembling some developmental forms of trypanosomata, the relation of the flagellum to the nucleus even in the most advanced

form is certainly not that found in a fully-developed trypanosome. Although it is possible that the parasites must be included among the class of *Flagellata*, the improbability that they belong to the genus *Trypanosoma* is the greater when we consider that the conditions present in infections by the parasite under discussion are entirely different from those of ordinary mammalian or human trypanosome infection, and for these reasons it would be rash to form an opinion as to the exact zoological position of the parasites until further work has been done.

Oriental or Delhi Sore.—It is satisfactory to note that the etiology of yet another important disease in India has been to a great extent cleared up as a result of recent researches. In view of the discovery in America of certain protozoal organisms in the tissues of a "tropical ulcer" or "Delhi Sore," Captain James, I.M.S., was directed in April, 1904, to proceed to Delhi for the purpose of investigating the etiology of "Delhi Sore." He found that in Delhi itself the disease was somewhat rare, but with the assistance of Civil Surgeons in other parts of India he succeeded in obtaining specimens from 13 sores diagnosed either as "Oriental Sore," "Delhi Sore," "Lahore Sore" or "Sind Sore." In the case of three of these sores the correctness of the diagnosis was doubtful, and in specimens from them nothing of importance was found. In specimens from nine of the remaining ten sores were found numerous parasites similar to those recently described by Wright as being present in a case occurring in America. The remaining case was a typical "Delhi Sore," but at the time of examination it had already lasted eighteen months and was healing up. There can be no doubt that true "Oriental Sores" occurring in India are caused by the parasites found by Captain James in so large a proportion of his cases, and the fact that the parasites were found in sores occurring in places so far distant from one another as Delhi, Karnal, Shahabad, Lahore and Quetta, indicates not only the wide distribution of the parasites, but also the identity of the disease known in India under so many names.* The Indian disease is no doubt identical also with the "Aleppo Boil" and "Baghdad Sore," &c., of other countries, for in addition to the case reported in America by Wright, Drs. Martzinowsky and Bogroff have recorded the finding of similar parasites in a case diagnosed as "Aleppo Boil" in Moscow. Captain James has compared the parasites obtained from cases of "Oriental Sore" occurring in the Punjab with those obtained by puncture of the spleen from cases of *kala azar* in Assam, and he considers that under the microscope the former parasites cannot be distinguished from the latter. On the other hand, he has carried out an investigation which goes far to prove that the parasite as met with in the Punjab, causes only the comparatively mild local skin affection known as "Delhi Sore," while as met with in Assam it causes only the dangerous general disease called *kala azar*. If this result is confirmed it will open up many interesting points for further investigation, some of which are the following: (1) the parasites of "Delhi Sore" and of *kala azar*, though very similar in appearance may in reality belong to different species, each producing a different pathological effect; (2) assuming that the parasites of "Delhi Sore" and of *kala azar* are identical, how is the fact to be explained that in one part of India they produce only a local skin infection while in another they produce only a general disease? (3) The point of infection in "Delhi Sore" is obviously the skin; if the parasites of this disease and of *kala azar* are identical the point of infection in the latter disease cannot be the skin, for even when numerous parasites are present in a "Delhi Sore" for months, no general disease like *kala azar* results, and the latter disease does not exist in some places where local skin infections with the parasites are not uncommon. (4) It follows that if any biting insect were shown to be the infecting agent of "Delhi Sores" it would not necessarily prove that *kala azar* is contracted by the same agency.

The investigation of Cancer.—In October, 1901, a scheme was initiated in England having for its object the investigation of the cause, nature, and treatment of cancer. For this purpose a fund—now called the Imperial Cancer Research Fund—was started, and in July, 1902, the investigation was set going, under the patronage of His Majesty the King, by the Royal College of Physicians of London and the Royal College of Surgeons of England. In the following year the Government of India were invited to co-operate in the investigation on lines similar to those which

* Since this paragraph was written, Captain James has found the parasite in films from four Frontier Sores" occurring in Dera Ismail Khan.

had been commended to the attention of the colonies. It had been pointed out by the Executive Committee of the Fund that in investigating cancer one of the chief matters of importance is to endeavour to ascertain whether the incidence of the disease is restricted to any race, or is dependent upon the circumstances of climate, soil, &c., and attention had been especially directed to the necessity for seeking whatever evidence there may be in India of the occurrence or non-occurrence of malignant new growths among natives. The Government of India accordingly caused a memorandum to be drawn up indicating the method and extent to which they considered assistance on these lines might be rendered to the Executive Committee of the Fund, and medical officers in charge of Government and other hospitals in India were asked to record their observations upon cases of cancer admitted to their hospitals in a form attached to the memorandum. The form provides for a complete description of each case and for all matters likely to throw light on the causation of the disease, and is prepared by the recording medical officer in duplicate, the original being sent to the Administrative Medical Officer of the Province and the duplicate direct to the Superintendent of Cancer Research, Victoria Embankment, London. The original reports received by Administrative Medical Officers are forwarded by them at the end of each year to the Statistical Officer of the Government of India in the Sanitary and Medical Departments. Writing in July, 1904, the Superintendent of the Fund stated that a considerable number of reports on cases of cancer had reached him from medical officers in India. He pointed out that while the majority of the reports were quite satisfactory, in a few cases the ages of patients had been omitted. Measures were taken to prevent this omission in future returns and the information supplied from India is now as complete as is possible.

Pasteur Institute of India.—The work of the Pasteur Institute, Kasauli, has increased enormously, but as the annual report of the Institute for the year ending August 8th, 1904, has not yet been published it cannot be noticed here.

The scheme for a Pasteur Institute for Southern India, for which a site has been selected at Coonoor in the Nilgiri Hills, is progressing.

Scientific memoirs.—Since the issue of last report the following memoirs have been published. No. 8.—A preliminary report on a Parasite found in persons suffering from enlargement of the spleen in India—By Lieutenant S. R. Christophers, I.M.S. No. 9.—Second report of the Anti-malarial operations at Mian Mir, 1901-1903—By Lieutenant S. R. Christophers, I.M.S. No. 10.—Specificity of Anti-venomous Sera (second communication)—By Captain G. Lamb, I.M.S. No. 11.—On a Parasite found in persons suffering from enlargement of the spleen in India—second report—By Lieutenant S. R. Christophers, I.M.S. No. 12.—On the morphology, teratology and diclinism of the flowers of Cannabis—By Major D. Prain, I.M.S.

Reorganisation of the Sanitary Department.—For some time past the problem of the reorganisation of the Sanitary Department has received the anxious attention of the Government of India. It was felt that while considerable changes were necessary to adapt the administration of the department to the requirements of modern knowledge, it was no longer possible that this administration should form only a part of the work of the officer selected to fill the office of Director-General of the Indian Medical Service.

The Government of India in their Home Department Resolution, No. 1273-1290 (Sanitary), of the 8th September, 1904, after sketching briefly the history of Sanitary Administration in India and discussing proposals recently laid before them for its improvement, give their reasons for determining that the first step to be taken in any scheme of re-organisation is the appointment of a separate Sanitary Commissioner with the Government of India. They define the duties of the Sanitary Commissioner in paragraph 10 of this resolution.

> His advice will be of value not only in settling in consultation with the local Governments and Administrations the principles on which an advance should be made, but also in giving effect to those principles, with due regard to local conditions and popular prepossessions, to the extent of the resources that are available from time to time. But the Sanitary Commissioner's work will also have another and an equally important side, the organization and direction of research throughout India, which will steadily increase with the progress of the scheme already sanctioned for the establishment on lines similar

to those recommended by the Plague Commission of fully equipped institutes for the study of health problems in India. This scheme provides for a central laboratory devoted mainly to original research of a general character, and the manufacture of antivenene and certain curative sera. In each of the larger provinces there will be a provincial laboratory, the primary functions of which will be to conduct diagnosis and special research connected with local conditions. One of these, the laboratory at Parel, will also carry on the manufacture of plague prophylactic. If the scheme is to be efficiently worked and to produce results which will justify the expenditure incurred upon it, the whole body of institutions which it comprises must be under the control of a competent sanitary expert who can supervise, organize and co-ordinate the work, can prevent conflict and overlapping, and being himself in charge of sanitary affairs throughout India, can determine what questions call for scientific investigation and where and by whom the work should be done.

They define his position in paragraph 12.

In dealing with technical sanitary questions the Sanitary Commissioner must obviously have a free hand. As regards administrative questions the Government of India have considered, but have decided to abandon, the idea of making him subordinate to the Director-General, Indian Medical Service. Efficiency and despatch of business will be the better secured if the Sanitary Commissioner has an independent position; while the co-operation and co-ordination which must be maintained between the two offices can be ensured without formally subordinating one to the other. It remains to define the relations of the new appointment to the provincial Governments. The Government of India have no intention of relieving local Governments of the direct control and responsibility which they have hitherto exercised in sanitary matters, or of weakening their authority over provincial sanitary establishments. The views held by the civil members of the Plague Commission upon this point are entirely endorsed both by the Government of India and His Majesty's Government. The main functions of the Sanitary Commissioner will as heretofore be to advise the Government of India upon sanitary and bacteriological questions. He will not be permitted to encroach in any respect upon the authority of local Governments over the officers under their control. But he will be empowered to consult and confer with them informally upon matters connected with sanitation and will in this respect occupy a position closely analogous to that of the Director-General of Education. He should also correspond unofficially with the provincial Sanitary Commissioners and the heads of provincial laboratories upon points of departmental procedure, form and statistics, and purely technical questions.

The Sanitary Commissioner with the Government of India entered on the duties of the new appointment on the 6th September, 1904.

ABSTRACT OF THE REPORT OF THE SANITARY COMMISSIONER FOR MADRAS FOR 1903.

(*Lieutenant-Colonel W. G. King, C.I.E., I.M.S.*)

General Population.*

In the presence of a prosperous season, it is probable that emigration has been less active than in the previous quinquennium, when high prices prevailed; but data are not available, as the usual returns by the Revenue Board have not yet been issued by it. The natural increase of the population according to registration was 768,735. The number for which registration returns were received during the year was 37,315,611, leaving 897,101† of the total census population unaccounted for. As usual, there has been no want of effort on the part of Government and the officers concerned to bring about improvements of methods of registration, and the whole subject was again considered by Government during the year (G.O., No. 329, Rev., dated 25th March, 1903). There are, however, two very evident flaws in registration in rural areas that cannot be ignored; one is the fact that control of Revenue authorities of zamindari villages is imperfect, and consequently as a rule the total average results in certain districts have been hitherto seriously reduced by errors owing to the omission of events. The statistics for 1903, however, show great improvement in this particular. The second is the impossibility of trusting registration to the existing agency, when a population assumes certain proportions. I have long held that the moment a town possesses 5,000 inhabitants, it is beyond the powers of the village revenue officials to keep a strict record of vital statistics. If this statement be true of villages containing a population of 5,000, still more is it correct of those of 10,000 and over, and I believe, whether compulsory registration be put in force or not, unless a special staff be employed such as might economically result by a combination of sanitary, vaccination, and registration duties under one department, that registration must still remain defective. Consequently, it has seemed to me necessary to secure that registration returns of towns should be so compiled as to exhibit separately towns having populations of above 5,000 and above 10,000, and showing where the registration is compulsory and where not; so as to be able to point out to the local authorities concerned where the flaws actually exist, notwithstanding the theoretical enforcement of compulsion. With the consent of the Revenue Board (Proceedings No. 177, dated 23rd May, 1903), the statements of vital statistics are now procurable compiled in this manner. The ruling had been in force for six months during 1903. The statistics obtained show that my contention as to the size of towns affecting results is sound. Notwithstanding compulsion in both instances, the total average for towns containing over 5,000 and below 10,000 inhabitants amounts to 28·1 for births and 21·1 for deaths; whereas in towns of 10,000 and over, the total average rate for births is 25·2 and deaths 19·8. In some of the towns containing 10,000 inhabitants, under compulsory registration, somewhat startling results are obtained; thus, in Yemmiganúru, in the Bellary district, the birth-rate is said to be 9·8 and death-rate 15·8; for Gopichettipoliem in Coimbatore district, the birth-rate returned is 7·8 and the death-rate 4·3; in Gudur in Nellore district, the birth-rate is declared to be 11·5 and death-rate 10·2; whilst Nellikuppam in South Arcot district, not to be outdone by its northern compeers, is content with a birth-rate of 3 and a death-rate of 2·9. The attention of the authorities concerned has been drawn to these results, and, as they are unusually bad, I had no struggle with my conscience in

---

* Throughout the Report rates per 1,000 only are quoted, unless it be specifically stated otherwise; consequently, the constant repetition of the words "per 1,000" is not thought necessary.

† This figure represents the combined populations of (1) the Agency tracts of Vizagapatam (850,960); Banganapalle State (32,259); Amindivi islands (3,608); and the Laccadives (10,274).

doing so; but, it seems to me a hopeless task for them to exhibit anything approaching correct birth and death-rates in towns possessed of populations of 10,000 or over, if the efforts of the Village Heads alone are to be relied upon. In Ganjám, statistical results are uniformly untrustworthy, owing to the apparent impossibility of the local authorities securing returns from the same number of villages monthly. In G.O., No. 628 L., dated 4th July, 1902, Government directed Collectors to select certain localities in their districts and to cause registration to be so effectually supervised that the cause of former inefficiency should be ascertained. Up to date, I am in possession of reports from only four Collectors on this subject. Beyond giving reason for a few cases escaping detection, no new fact of importance is revealed, except that in one union, where compulsory registration was in force, there had been neglect to require attendance of the Registrar at definite hours.

To all Municipal Registrars has been sent a pamphlet written by my late Personal Assistant, Assistant Surgeon Kistnamurthi, in which all common diseases are described in simple language. This, in addition to the course of instruction to Municipal Registrars by District Medical and Sanitary Officers previously arranged for, should go towards improving accuracy of registration of death causation.

In municipal areas, disobedience to compulsory clauses of the Act was followed by prosecution in 1,264 cases.

Births in Districts.—The total number of registered births being 1,165,080, the birth-rate of the Presidency during 1903, when reckoned upon the census population, is 31·2, against the average of the preceding 10 years ending 1900 of 28·5, of 25·1 for 1901, and 28·2 for 1902. A certain amount of this increase is discounted by the fact that, when reckoned upon the estimated population, the birth-rate is 30·6. Nevertheless, there is room to think that some improvement has occurred in registration, and no room to doubt that removal of the depressing influence on fecundity of high prices of food has been recovered from, as an effect of the prosperous seasons of 1902 and 1903. In my report of 1901, I pointed out that the districts of Chingleput, North Arcot, Madras, Kistna, and Kurnool suffered special diminution of their birth-rates, in all probability in response to this influence; and I suggested, in my Report of 1902, it would be of some interest to ascertain whether these districts, which showed decreased birth-rates out of proportion to those of other districts which had been less affected, would exhibit a reaction at a greater rate than these, as soon as the results of better food supplies had time to operate. Taking Chingleput, it is found that, in 1901, the birth-rate was 26·6; this has increased to 39·2, thus exceeding the total average by 3·6. Kistna has from a rate of 27·2 advanced to 33·5. Kurnool from 23·3 has advanced to 31·3, thus exceeding its total average of 30·2. Madras has advanced from 37·1 to 39, but it has not yet reached the total average of 40·9. Here, as already noted, prices have not fallen to the same extent as elsewhere. North Arcot from 19·1 in 1901 has advanced to 29·1, and, therefore, has exceeded the total average by 1·4. On the other hand, the birth-rate of the year has exceeded the total average in 15 of the remaining 17 districts, which were also subjected to the strain of high prices, but in a less marked degree. Of these, Nellore and Malabar should have also been selected by me. There is, therefore, sufficient reason to regard the rate of recovery in the affected districts since 1901, with the exception of Madras, as proportionately greater than during the period when prices were continuously nearer normal. Such facts as these go to disprove the popular opinion that high prices of food and epidemics specially affecting infantile life, cause decrease in the population, or, put in another way, that scarcity of food is a divine dispensation in respect to increase of population; there are physiological reasons why this opinion would be true only if the causes were permanently in operation.

Deaths in Districts.—Notwithstanding the increased birth-rate and its frequent sequel of increasing the total mortality by increased infantile deaths, the total death-rate of the Presidency was but 22·2 against the total average of 21·4, and, when reckoned upon the estimated population, 21·7. No notable increase of mortality has occurred except in Anantapur, Coimbatore, Salem, South Canara and Malabar. In the case of the first four districts, the increase is due to plague. In Malabar, irrespective of improved registration (which is evident from the simultaneous better birth-rate registered side by side with the increased mortality), the

increase seems to have been chiefly due to cholera. Exclusive of cholera, small-pox and plague, the total mortality of the Presidency was 770,964, affording a rate of 20·7.

Reckoned upon registered births, the total deaths of infants below one year of age was 177·6 against 168 of the preceding year—an increase largely due to mortality of infants in plague-infected areas. In both years, the ratio of deaths was practically the same, namely, 100 males to 90·1 females in the year 1903 against 100 males to 90·2 females in the year 1902. In 12 districts the average of 9·9 per cent. difference between male and female deaths was exceeded. The highest rate registered was in Madras and Chingleput districts, where it amounted to 286·1 and 210·6, respectively. It is probable that the marked endemic prevalence of diarrhœa and dysentery in these districts had much to do with this result.

Births in Municipalities.—85,824 births were registered in municipalities in a census population of 2,406,455, representing a birth-rate of 35·7. On the estimated population, the birth-rate would be 34·6. The ratio of male to female births was 100 to 94·3. This may be contrasted with the ratio for England and Wales from 1896 to 1900, which was 100 males to 96·6 females. When compared with last year, Coimbatore, Ootacamund, Tiruppattúr and Vellore, exhibit slight decreases in their respective rates which may be accounted for by exodus of the people during plague, and by less efficient registration of births during stress of preventive work. But, on the other hand, Adóni and Bellary, which were similarly affected, show no such decrease. Cocanada, Masulipatam, Periyakulam, Kodaikánal, Tirupati, Vániyambádi, Tinnevelly and Srívilliputtúr show a falling off in results, which may fairly be ascribed to careless registration. With the exception of the towns named, an increase of the birth-rate has occurred in all municipalities; a result which may be ascribed, in part, to improved registration, and, in part, to relief from the conditions incident to dear food which have already been referred to. The highest registered birth-rate of 50·2 is reported by Vániyambádi against that for the preceding year of 63·1. This falling off of the normally high birth-rate of this town, notwithstanding the continued presence of a large section of Muhammadans who are well off and possessed of zenanas, is probably due to the fact that the population has suffered heavily from plague, and that some amount of emigration has occurred. Of municipal towns not possessed of this abnormal character of the population, Karúr has shown the highest birth-rate, namely, 45·3.

Deaths in Municipalities.—The total mortality rate for municipal towns for the year, namely, 32·7, shows but little change when compared with that for the preceding year, namely, 32·5. The chief change in causation of mortality was a slight decrease in the case of cholera and small-pox, and a slight increase in the mortality from plague. In the municipal towns of Coimbatore, Ootacamund, Coonoor, Vellore, Vániyambádi and Tiruppattúr, the increased mortality was due to plague. In Chicacole, Berhampur, Palni, Calicut, Gudiyáttam, Dindigul, Cuddapah, Parlákimedi, Karúr, Cochin, Trichinopoly, Mánnárgudi, Vizagapatam and Tiruvannámalai, the apparent increase is due to increased activity in registration, as the birth-rate has synchronously increased. In Tellicherry increased mortality is exhibited under "dysentery and diarrhœa," "respiratory diseases" and "fevers." Such a combination would give rise to suspicion of the existence of unrecognised plague. The Civil Surgeon informs me that he has no reason to suspect that this has been the case. In Salem, there has been a remarkable increase in the efficiency of registration, as the birth-rate has advanced from 37·1 in 1902 to 43; the heavy death-rate obtained is largely due to this cause, as, if deaths from cholera, &c., be subtracted, the more reasonable mortality, having regard to the birth-rate, of 34·0 per 1,000 is arrived at. It is probable, however, the full birth-rate has not yet been secured in this municipality, but I think it very unlikely that cases of death escape notice, as the town has throughout the year been under the system of observation for plague, and, by personal inspection, I have ascertained that the duty of checking mortality is very carefully carried out. The severe rate of 162·4 in the case of Vániyambádi is in part accounted for by the heavy incidence of plague in the town, owing to the inhabitants obstinately refusing the precaution of evacuation. This was also added to by a number of deaths during floods, which swamped a portion of the town in November, 1903.

In 1902, the total average infantile death-rate in municipalities reckoned upon the registered births per 1,000 amounted to 233·3, and, in my report for that year,

I pointed out that the decline of 4 per 1,000 compared with 1901 recorded for that period probably represented the withdrawal of the influence of high price of grain upon the adult, and its indirect influence upon infantile life. This remark is justified by the practically unaltered figure for 1903, which is 234 against 233·3 for 1902. The proportion of male to female deaths among infants below one year of age was 100 to 88·5 against 90·2 in the previous year. By way of contrast I may state that the proportion for England is about 100 males to 79·5 females. It is possible the difference may reflect in some degree the less care likely to be taken of females than males when sickness overtakes them in this country by the uneducated classes. The average difference of 11·5 per cent. between male and female deaths was exceeded in 31 towns, in 19 of which the variation was more than 20 per cent. Whilst this total average rate is decidedly heavy and must imply great avoidable mortality, those for Masulipatam (288), Ellore (299·6), Guntúr (331·1), and Bezwada (333·7) are records of a lamentable loss of infantile life. These towns are within the districts of Kistna and Gódávari, where the inhabitants must have much the same customs and method of treating infants. The only other places outside these districts where the same results are approached are in the crowded and insanitary City of Madras (286·1) and in Tuticorin, which is famous for its brackish and unsatisfactory water-supply (288). Unfortunately, to arrive at a conclusion as to the nature of this large mortality, information such as is not now available in statistics furnished for this report would be necessary; that is, the actual nature of causation of death has to be ascertained, and even then one is confronted with the difficulty that the causation stated by uneducated mothers must be received as sufficient diagnosis by municipal registrars. It is in the investigation of such matters that my suggestion to group registration according as they have been verified by medical diagnosis or not, would have been of peculiar value (G.O., No. 1767 M., dated 26th November, 1903). In the meantime, the matter is one which should engage the attention of the District Medical and Sanitary Officers concerned. As soon as the medical aspects of the question are at disposal, the sanitarian's function could doubtless be exercised with value; but this preliminary is necessary. One of the genuine predisposing causes of "convulsions" which form so frequent a cause of death as registered, amongst native children certainly is the means taken by anxious mothers to prevent them, namely, by producing open and slow-healing wounds subject to contamination by the earthen floors of dwellings by branding them with a red-hot needle on the abdomen; although I think this is less frequent than in former days. If actually these convulsions be proved to be due to tetanus, it would be most desirable to attempt Calmette's preventive treatment by the use of dried anti-tetanic serum powder. This, on the opening of the Serum Section of the King Institute, is a point that will be kept in mind. In any case, disregarding the trite fact that heavy infantile mortality bespeaks a high grade of local insanitary conditions, it is certain that the sanitary reformer and the educationist have before them a duty in securing that native mothers should better understand the care of infants. In such matters, by the spread of knowledge by means of pamphlets, Mrs. Brander, a late Inspectress of Schools, has to my knowledge done much good; but there is ample room for more lady workers.

Chief Diseases.

Cholera.—There was a decline in the incidence of cholera in the population when compared with the previous year, the rate being ·7 against ·8. The districts most severely affected were Madura and Malabar. The conditions in Malabar, in the rural parts, are not at first sight favourable to the spread of cholera, owing to the frequency with which the people reside at distances from each other, and utilize water-supplies which are within the private control of individuals. Nevertheless, there are portions of towns, especially parts inhabited by Moplahs, which present exactly the opposite features; there is much overcrowding and the water-supplies are open to contamination. It is customary for local officials to regard the former condition of affairs as typical of the district, and to hold that sanitary requirements are very few. Guided by such opinions, the Malabar District Board last year (1902-1903) spent under the head of sanitation only 0·23 per cent. of the total revenue against an average of 5·57 per cent. expended for that purpose in the other districts of the Presidency. Whatever impression be conveyed to the

casual observer of scattered residences and ample water-supply, there can be no doubt there is much solid sanitary work that demands attention in this district. Certainly the idea that no special sanitary care is requisite does not seem to fit in with the fact that typhoid appears to have a special predilection for Malabar, and that it returned the heaviest cholera mortality during 1903. The next district in the order of severity of affection is Madura, where the mortality from this cause was 4,422. Possibly, the large number of zamindari villages in this district handicaps local authorities as to efficiency of sanitary control during epidemics. In any case, neither here, nor in any other area affected with cholera under District Boards, is there reason to believe that the Sanitary or Medical Staff employed was sufficient in numbers to cope with the duties on which they were placed.

At Guindy, in the Chingleput district, an interesting outbreak came to my notice. A bricklayer, resident in Mylapore, was attacked with cholera when working in the compound of a public building situated on the banks of the Adyar. He was known to have vomited and purged on the banks of the river. The same night there was rain. In three days cholera made its appearance in the village at Guindy, which obtained its water-supply from a spot about a quarter of a mile below it on the same bank. A temporary water-supply was opened by the people; but 24 deaths in the population of 431 occurred before the epidemic was arrested. With one exception, all cases had used the water up to the date when it was declared infected. It so happened that from the same source the Government House at Guindy was supplied *after filtration* for minor domestic and garden purposes; drinking water being obtainable from a different source. The household was absent during the period, but, although a few servants were present, none of them were attacked. Seeing that this part of the river, in spite of magisterial injunctions to the contrary, is liable to fæcal contamination as well as from the washings of clothing, it certainly is not a spot that can commend itself as a fit source for the water-supply of a large household, notwithstanding its rough filtration and restriction to minor offices. I thought I had obtained in this case an "object lesson" that would not be thrown away upon the local Taluk Board. Therefore, with some confidence that my suggestion would be adopted, I forwarded a scheme for a small-water supply at 10 gallons per head for the village to be derived from a clean subsoil source. Lifting was to be fulfilled by a kerosine oil engine pumping to an elevated iron reservoir, whence it was to be distributed by pipes and taps throughout the village. The Taluk Board of Saidapet was not, however, to be thus hastily disturbed from that state of equanimity with which it has for years regarded sanitary matters. With the District Medical and Sanitary Officer's concurrence, they pointed out that the same well which would have been protected under my scheme was already available for the people, and that "during the prevalence of cholera, the Taluk Board would protect the well from contamination by appointing a watchman." It did not seem to enter into the Taluk Board's calculation to consider this particular well (unprotected mechanically) might be the first contaminated, and be the means of the spread of cholera, notwithstanding the appointment of that constant scapegoat of the sanitary conscience of public bodies, known as the "tank watchman." I quote this little incident, as evidence of the difficulty that is encountered in securing even petty sanitary advance by rural bodies. Although £160 may be regarded as a large sum for a Taluk Board to provide, still it is obvious the arrangement would have represented once and for all a permanent improvement in the village concerned. The upkeep of a kerosine oil engine neither demands great skill nor unreasonable expenditure for fuel. The question of attempting to persuade local bodies to undertake methods of protection of water-supplies by definite mechanical means, instead of by the omniscient tank watchman, has been much pressed by Government in its reviews of reports during 1903, and its importance will, it is hoped, in time force itself upon notice.

In municipalities, the incidence of cholera decreased from a rate of 1 of the previous year to ·9. The towns most severely affected were Salem (9·8), Periyakulam (5), Cochin (4·9). These towns have notoriously evil water-supplies. In Salem, the washing of clothes proceeds at portions of the river above the town from which water is drawn by people for drinking purposes, although during cholera prevalence its use is discouraged. Into this river is discharged much of the drainage of the town, although of late the Municipal Secretary, who is a Certificated Sanitary Inspector, has managed to persuade the Council to divert a considerable amount of it to sewage filters, so as to use the filtrate for farming. At

Periyakulam, the whole washings of the town proceed to the particular part of the river, which forms the chief water-supply. At Cochin, the supply obtainable locally is brackish, and is largely drawn direct from shallow unprotected holes dug in the sandy soil within inhabited areas. The improvement of the water-supply in these three towns has long been considered. In the case of Salem and Periyakulam, the question is chiefly one of finance; whereas, in Cochin, there are certain physical difficulties that have to be overcome. In this latter case, however, the problem of protecting the existing water-supply against both cholera and filariasis (for which the place is notorious) is of the most simple nature: but the Council continue to regard this aspect of the question with apathy. In the meantime, these towns afford good examples of the results of unprotected water-supplies.

So far as the method of spread of cholera is concerned, I see no reason, with further experience, to modify the views expressed by me in my report for 1893 (page 58 *et seq.*). The chances are, irrespective of well-recognised facts following introduction into a locality, that, in certain areas, the cholera microbe exists in water in a modified or feeble condition and that the epidemic appearance is due to enhancement of its virulence following inflow of suitable pabulum especially from the subsoil and possibly from the surface. At any rate, in this Presidency, cholera is confined in certain districts to certain months with clock-like regularity. The bacteriologist has left the sanitarian with no more information than was obtained by Koch originally as to the behaviour of the cholera microbe. It seems to me there is plenty of bacteriological work applicable to epidemiology that should secure attention. As regards distribution, the sacred River Cauvery is obviously an active agent.

Small-pox.—Vaccination is compulsory in all municipalities, and in only 145 of the 379 unions in the total area of 142,121 square miles of the Presidency. The fact, however, that of the total municipal population of 2,406,455 only 0·1 died from small-pox goes to show that, in spite of possible frequent chances of importation, the influence of protection afforded by vaccination is demonstrable. In rural areas, 0·4 per 1,000 (or 14,667) of population died of small-pox, against 0·7 (or 22,926) in the previous year. Of these deaths, 6,984 were below 1 year of age, giving a rate of 6·47 per 1,000 of births; whilst 4,017 were between 1 and 10 years of age, or at the rate of 0·46 per 1,000 of the population of that age. In municipalities, there were 71 deaths of infants below 1 year of age or 0·83 per 1,000 of births, and 127 deaths between 1 and 10 years of age, or at the rate of 0·21 per 1,000 of the population of that age. These figures show clearly the advantage of the more prompt vaccination of infants in municipalities than now occurs in rural areas, and especially the influence of the more uniform protection afforded to children under 10 years of age which necessarily follows. The large mortality of children under 10 years of age from this preventable disease is a matter that has engaged the attention of Government for some time past; and it recently called for a scheme for the reorganisation of the Vaccination Department coupled with compulsory vaccination in rural tracts. This should prove a most valuable reform and should, within a short period of its inauguration, be capable of showing much life-saving power (G.O., No. 1558 L., dated 7th December, 1903).

Plague.—A total of 13,291 deaths from plague was recorded, of which 6,203 were cases of females and 7,088 cases of males. The total rate of mortality in the aggregate population of the districts infected was 0·5. Of this figure, the Bellary district contributes the high rate of 6·2. The districts indigenously affected were Anantapur, Bellary, Coimbatore, Kurnool, the Nilgiris, North Arcot, Salem and South Canara. Plague has therefore acquired possession of the central districts of the Presidency. Fortunately, the epidemic in South Canara has never assumed large proportion, and no spread along the West Coast has yet occurred. As a special report is annually made on the subject by me, it is not necessary here to enter into details. I may, however, state that the policy pursued by the Madras Government has varied little from the commencement of plague in Bombay up to date, except that the great safeguard of early evacuation has been trammelled, so as to give the enemy a decided advantage. The result has been, on the whole, the contesting of the advance of plague inch by inch, as contrasted with a policy that would first permit of its presence being demonstrated and then taking action. The system is not without the drawback of expense; but even omelettes cannot be

made without breaking eggs. During 1902-03, the total spent on behalf of Local Fund Boards and Municipalities under plague charges was Rs. 4,03,927 (£26,928), so that the contribution per head of the population of the Presidency for the year was 2 pies. So far as it is possible to gauge facts, it would seem that in restraining the advance of plague throughout the Presidency, the money demanded is well spent, in that trade and lives are husbanded. Even if it so happens the advance of the disease should prove irresistible, and the weak measure of attempting to restrain the spread of the disease only after it is proved to be actually present be resorted to, instead of attempting to prevent its securing a foothold, which is the leading feature of the existing policy, the chances are considerable that the inimical result upon public funds would be even more marked than at present, as the producer would be more seriously crippled.

In my report of 1902, I invited the attention of Government to the lack of bacteriological knowledge that should prove a safe guide to the sanitarian, with special reference to the theory of "recrudescence," which is, up to date, popular in India in connection with the supposed survival of the microbes on or in the soil. It seems to me that it is important that this question should be thoroughly threshed out by a specially appointed bacteriologist. The technique of such a subject is beset with many difficulties, like other matters that require a certain amount of perseverance to overcome them, but it would be absolutely economical to appoint a specialist capable of working out the subject fully, even if a liberal salary for several months and an honorarium were to be debited to "plague charges." At any rate, from the sanitarian's point of view, it is absurd to go on spending money in disinfecting with such rigour the walls and floors of houses, without full knowledge of the microbe's capability of survival and fitness to increase in such environments. If, for instance, the bacteriologist would relieve the sanitarian as to burden of doubt as to the period of survival of the plague microbe in earthen floors and walls, and especially as to possibility of its "growing through" soil, as apparently on poor grounds maintained by Yersin, it would be a cheap, easy, efficient, rapid and cleanly method to apply the intense heat of the kerosine oil blue flame (8,000—25,000 candle power is easily secured) under air pressure at the end of flexible tubes to all indestructible surfaces, so that by merely painting over them death of the exposed plague microbes would be certain. This I have already shown by bacteriological experiment to be the probable result. But such results, when secured otherwise than on the surface of soil, are rendered dubious by the presence of air and moisture in the interstices, and are far too slow for work in practice. Surely, an answer to the question is worth having and paying for. In every village in this Presidency, kerosine oil could be obtained, whilst the machinery to give air pressure need be but of the most simple nature. The method of recording plague in this Presidency and the passport system enable each case of first appearance of the disease to be traced with fair accuracy. Investigation of records by me for this purpose goes to prove that town after town that has been infected has suffered solely from importation, and not from recrudescence of the disease of a past season; and that, similarly, it by no means follows that a town once infected may be visited again by the disease. The truth seems to be that plague is kept up not by germs retaining their vitality in formerly plague-infected dwellings, but by direct descent through cases that are not detected by the local authorities, either as a result of too early withdrawal of the sanitary staff during the hot season, or its too great attenuation for the purposes of economy, so that there is failure to maintain correct surveillance of the population concerned. Therefore, the idea that plague must exist in this or any other country for a number of years until its cycle has been fulfilled, seems to me altogether theoretical; in practice, an honest appreciation of the fact that the surveillance of the population should be as active during the hot season when plague wanes, as during the cold season when it waxes, would definitely refute an opinion that is an excuse for, and breeds, apathy. Above all things, much more attention seems to be necessary to secure plague-infected clothing than is possible under a mode of disinfection which requires soakage in liquid disinfectants, and its temporary removal from the owner. The best way to secure confidence *and* the clothing of inhabitants is undoubtedly by the use of a good class of steam disinfector, which is capable of doing its work rapidly at the doors of the infected dwellings in front of the owners concerned, so that they find themselves possessed of their clothing without appreciable deterioration. This view the Government of Madras is now attempting to meet and one light steam

disinfector (Alliot and Paton) has already been imported, and it is hoped before next plague season this Presidency will be in possession of a number of light steam portable disinfectors possessed of vacuum and steam pressure arrangements, worked by means of kerosine oil instead of solid fuel. The use of kerosine oil will enable the apparatus to be lightly built, whilst it possesses the advantage of being procurable in every bazaar in the country. Putting aside the risk of being re-infected from foreign areas, I feel convinced that the energetic working of staffs during the hot weather and more effectual arrangements as to disinfection of clothing than at present existing, would render it possible to absolutely stamp out plague. Such statements ignore infection amongst rats. But I have never yet heard of proved recrudescence through rats. There is against this the evidence of the second appearance of plague in Glasgow, but the chances are there as elsewhere fresh importation had occurred. Rats may be trusted not to stop in any place where their lives are unsafe by reason of disease, or are rendered uncomfortable by reason of various appliances to that end used by human beings. Undoubtedly, much of the plague infection of this Presidency has been derived from Mysore, where there is an unusual method of treatment of plague, the chief feature of which has been that no compulsion has been applied. This is closely allied to the so-called "common-sense plague policy." During the year, a conference with the authorities concerned in Madras and in Mysore was held, at which I was present. Although that grade of sanitary co-operation with this Presidency which, it was hoped, would be secured, has not been fully attained in Mysore, the Government of that territory has at least sanctioned a staff, the object of which is to secure inter-communication between Mysore and Madras districts. Nominally, at least, disinfection is now compulsory. It is hoped that, during the ensuing year, Mysore may prove of less danger to Madras than it has hitherto.

Fevers.—In municipalities, the death-rate from fevers was 6·3 against 6·7 in the preceding year, and in districts, 8·4 against 7·7. Having regard to the fact that plague prevailed in certain of the districts, the small variation under the head of "fevers" and absence of a marked increase under "all other causes" bespeak a fair amount of accuracy as to finding cases of plague, and, therefore, the prevention of their being placed under incorrect heads of registration. The town of Madura shows an increase under fevers of 1·2. The Chief Certificated Sanitary Inspector has shown that, in several localities of the town, the anopheles mosquito is present. A possible rise of fever prevalence in this district should be watched for by the local authorities with care. Under the influence of the Periyár project, large tracts of formerly dry land surrounding the town are being placed under wet cultivation. It is possible that the necessary conditions of a human germ bearer and a readily-infected species of anopheles may yet conjointly exist, although at the present time so far as the rural tracts are concerned and statistics disclose, no evil results have occurred. Nevertheless, the necessity throughout this district for carefully getting rid, by efficient drainage, of the water that has fulfilled its function of irrigation should be held in mind. Kurnool shows a decrease of 3.9 of the fever rate. The registration is probably fairly correct when judged by the existence of an increased birth-rate, the total diminished death-rate, and the lack of tendency to quote deaths under any other particular head. This diminution is therefore apparently in direct response to altered conditions as to irrigation surrounding the town. In 1881, when Vice-President of this Municipality, I was able to prove by records in my possession to the Municipal Council that the introduction of malarial fever into the town immediately followed the large use of irrigation in the vicinity, and advised that a zone of a mile radius should be established round the town, in which no wet cultivation should be permitted. Fortunately, the belief deduced from long observation by formerly received authorities as to the influence of moisture on earth and its removal by drainage, which existed at this time, under the impression that the earth contained the germ (which may yet in part be proved correct) made no difference as to the results. On adoption of this measure, a marked fall of the fever rate occurred: but, as years passed, the Council became less strict in observance of the zone and the fever rate increased. Government recently ruled, on a reference by the Collector of the district, that not the mile zone but the whole of municipal limits* should be free of wet cultivation. Cuddapah,

* The change has not materially altered the size of the zone.

which shares with Kurnool the unenviable notoriety of being highly malarious, is also about to secure a dry zone within its municipal limits, which will doubtless prove helpful in restraining the conditions favourable to the incidence of malarial fever. On the opposite, Masulipatam is increasing its wet cultivation in the immediate neighbourhood of the town. I found in pools on its outskirts no lack of anopheles held to be good malaria bearers. Here, the expenditure of considerable capital for conducting drainage on the method employed in Holland would be necessary to secure efficient results: but much valuable land would thereby be rendered arable, and would be an offset to expenditure.

The question of the extent to which malarial fever prevailed in the Madras City has been a matter of medical and sanitary discussion for several years. That malarial fever can be acquired in Black Town is indubitable; but it has been long perceived that the cases recognised as malarial fever and accompanied by enlargement of the spleen did not respond readily to quinine treatment, and pursued a curiously obstinate course. In my own experience, a marked characteristic of this form of Madras fever was the frequency of the occurrence of lobular pneumonia as a complication. Although the subject is yet incomplete, the highly important researches of Captain Donovan, I.M.S., who found certain micro-organisms in the spleen, which have been named after him *Piroplasma Donovani*, and an investigation which subsequently was opened up, under the orders of the Government of India, by Lieutenant Christophers, lately on duty with the Malaria Commission, go to prove that this fever is not malarial but of a type depending upon the presence of the specific bodies discovered by Captain Donovan, of which the nature is not yet fully ascertained. If this enquiry be successful, it will form an important addition to medical science generally, and will prove of special benefit to the City of Madras which has so long suffered from this hitherto misunderstood form of fever.

In June, 1900, I sent a circular inviting all local bodies to take advantage of the discovery of Ross as to the connection between the mosquito and spread of malarial fever, and especially pointed out that, granted the hitherto recognised policy of drainage of large areas was beyond their means, the palliative mode of causing destruction of mosquito larvæ in pools by kerosine and of the germ in the human being by means of quinine, was at least open to them. For this end, they were advised to select areas for experiments. With the exception of the Kurnool District Board, which put aside a sum of Rs. 500 for an experiment, no action of importance followed. This seemed to me greatly due to absence on the spot of persons trained to observing mosquitoes and their larvæ. I consequently, as stated in last report, assembled a class of Sanitary Inspectors at the highly malarious village of Dhone in the Kurnool district, and trained them for the work. Since then, I have attempted to follow up action taken by the men on their return to their municipalities, by means of reports through the chairmen of the municipalities concerned. They were particularly directed to insert in a map of their towns the spots where anopheles pools were found, and ascertain the subsequent influence of their disappearance under their efforts towards destruction, or removal of the water by filling in or draining. With few exceptions, Certificated Sanitary Inspectors have taken up the matter energetically and the Chairmen concerned have encouraged their efforts. Reports of special interest as exhibiting progress have been received from Certificated Sanitary Inspectors G. C. Nallaswami Pillai (Madura); K. Seshagiri Rao (Cuddalore); T. C. Sankara Kurup (Calicut); S. Sitharama Aiyar (Cocanada); T. S. Venkatarama Aiyar (Conjeeveram); M. Venugopalaswami Pillai (Bellary); and S. Velayudam Pillai (Palamcottah). In reviewing progress of efforts towards extermination of malaria (G.O., No. 1343 L., dated 17th December, 1902), the Surgeon-General called the attention of Government to my proposal made to local bodies to select areas for experiment, and suggested that definite orders as to this should be issued. The result has been that Government has directed that funds be allotted by local bodies for experiments in six carefully selected areas, having for their object the extermination of malaria by the conjoint use of mosquito larvæ destruction, administration of quinine to human beings, and minor engineering works.* The officer selected for the duty will work under this Office, and will have attached to him an intelligent engineering subordinate. There are here, therefore, the elements for a thoroughly honest trial of modern methods of dealing with malaria.

* The necessity for a reversion to the ancient policy of making engineering works the first line of defence, is well borne out by Lieutenant Christophers' candid estimate of results secured in Mian Mir (Second Report of the Anti-malarial operation at Mian Mir, 1901-03).

Dysentery and Diarrhœa.—In rural areas, the total average death-rate from dysentery and diarrhœa amounted to 1·1, whereas, in municipalities, it amounted to 4·6; in the former case, the highest figures reached were in the Nilgiris (3·3), in Malabar (2·8) and in Chingleput (2·7). Such rates are, however, small when compared with those obtaining in the municipal towns of Palamcottah (14·9), Tiruvannámalai (11·0), Vizianagram (8·1), Cochin (7·7), Periyakulam (7·5), Coonoor (7·4), Gudiyáttam and Vizagapatam (7·2 each), Tuticorin (7·0), Parlákimedi (6·9), Masulipatam (6·8), Chingleput and Vellore (6·6 each), Tirupati (6·1), and Conjeevaram (6·0). It would serve no good purpose for me in this report to descant upon the individual local causes which lead to these results. It is obvious that the aggregation of human beings upon a site, as found in large towns, is more favourable to the propagation of the causes of diarrhœa and dysentery than in the more thinly populated villages of rural areas, and that defects of water-supply and of badly conserved soils are more liable to exhibit their mark in a locality where certain conditions of natural soil and surface and subsoil drainage exist than in others. The more experience accumulates in reference to these diseases, the more it is evident that a town cannot rely upon abolishing them by simply taking a new supply of water, and that the supply must be so distributed that its inhabitants shall not have recourse to inferior water at intervals, and, even when this is attended to, that the soil must be kept pure, as a result of correctly conceived and correctly carried out conservancy systems. There are eleven towns at the present time which possess expensive water-supply systems in this Presidency to which these criticisms are applicable, whilst in no case can it be said that the conservancy system of any municipal town is complete. It is a curious fact that a people who are possessed of scriptures which are spoken of with reverence by them, and which lay down rules of great hygienic value as to the disposal of human excretions, should find no representative in Municipal Councils that would take up the matter of conservancy seriously. In a town famous for its advance in European education, where the municipal representatives are largely vakils, always profoundly happy at the prospect of a debate at its Council meetings, I found, in a thickly-populated area, up to the door of an important temple, a normal not casual place of easement.

Injuries.—The rate for injuries noted for the year 1902 was maintained during 1903, namely, ·4. As usual, suicides of females were in greater proportion than those of males, namely, 100 of males to 125·3 of females.

All other causes.—Under this most unsatisfactory heading (so far as nosological purposes and the possibility of locating diseases are concerned), 45·9 per cent. of the total mortality was registered. Having regard to the presence of plague in the Presidency, the possibility of an increased number of events being registered by the people under this heading, with the object of getting rid of plague measures, is necessarily of importance to local authorities. Notwithstanding that the total plague cases for the year were 2,496 more than in 1902, the advance under this head, granting there is any necessary connection between the two, does not seem to have been of much importance, namely, 1 per 1,000 more than the former year (9·2). The increase was not confined to districts affected with plague.

Sanitary Works.

Municipalities.—It goes without saying that the possession of a soil free from contamination by rubbish and more especially by human excrement, is of prime importance to the health of a town. In recognition of the value of soil cleanliness, in the present day, many towns in Great Britain do not scruple at great expense to flush narrow court-yards within insanitary areas, at regular intervals. The late Boer war afforded a repetition of a familiar hygienic lesson, by again proving that the uncleanly soil of even temporarily inhabited areas was followed by a distribution by means of dust, flies and water, of the causative agents of diarrhœa, dysentery and typhoid, with the attendant heavy, yet preventable, mortality. Municipal Councils, although undoubtedly improving year by year in recognition of the importance of soil cleanliness, still leave much to be desired in this respect. For instance, in the town of Madura, which has a population of 105,984 and therefore ranks as the second largest town in the Presidency, the number of public latrines

is eight specially built for the purpose (and, in this respect, it is worth remembering that these latrines are usually for males and females in one spot, and, therefore, they should obviously be quoted as four only) together with four brick wall and one mud wall "simple enclosures." It also possesses 12,000 so-called "private latrines," of which, however, only 5,356 (serving a population, say, of 26,780) are cleansed by municipal agency, whilst it is doubtful if any form of systematic cleansing of the remainder really takes place unless that agency be employed. Under such circumstances, a large part of the duty of the night-soil collecting staff consists in perambulating the nooks and corners of inhabited areas. Under this system even if the fæcal matter were removed, it cannot be imagined that it is so fully effected as to leave the soil uncontaminated, and that dust and flies may not serve as distributing agents of pathogenic germs. In quoting the case of Madura, I have merely chosen it for illustration, on account of its large population; its incomplete system of conservancy is but typical of what occurs in a less degree in certain other towns. On the other hand, it must not be thought that advance, however slow, has not been made steadily from year to year. Thus, one of the errors constantly made by Councils is the neglect of the removal of the night-soil in favour of rubbish. Hence, readjustments of staffs demanding an increase of scavengers for night-soil removal and a decrease of sweepers for rubbish removal, usually denote a tendency in the right direction. The use of light tramways, or a suitable adaptation of the Shone system after the Warrington method for rapid removal of night-soil, is within the financial capabilities of some municipalities, but conservatism in favour of lumbering bullock carts will take some time to disappear. During the year, the number of sweepers was decreased from 2,671 to 2,603, whilst that of public scavengers was increased from 1,456 to 1,480. The night-soil carts have been increased from 764 to 867. If the whole mass of the municipal population be regarded, exclusive of Madras City, it is found that, for each 10,000 there are 0·6 Sanitary Inspectors, 3·0 conservancy subordinates, 7·7 public night-soil scavengers, 12·3 municipal scavengers serving private houses and 13·6 sweepers. In 1894, the proportions were 1·2, 2·8, 6·7, 6·1 and 14·3. The Sanitary Inspectors of that year were unqualified, and consequently their reduction in quantity, in favour of the smaller number of Certificated Sanitary Inspectors of the present day, represents no loss.

In reference to disposal of night-soil, there is evidence of advance; its utility for agricultural purposes, notwithstanding caste prejudices, is year by year more fully recognised. Thus, during 1902-03, municipalities realised under rubbish and night-soil disposal the sum of £2,806 against £2,788 in the previous year and £1,518 during 1892-93. In regard to utilisation of sewage there are *promises* that action will be taken by Chingleput, Karúr, Chicacole, Tinnevelly and Bezwada. Kumbakónam, Negapatam, Tanjore, Rajahmundry and the City of Madras continue to secure good financial results by their efforts in this direction. Vizianagram and Vizagapatam, under the stimulating care of the present District Medical and Sanitary Officer Major Vickers, I.M.S., have made specially useful endeavours by diverting sewage from directions where hitherto its effects were harmful. In Tanjore, the net profit from sewage farming was £126; in Madras City it amounted to the sum of £2,402. Modified filter trenches to replace cesspools have been introduced under my advice with success in Cuddalore, Palamcottah and Periyakulam. For the last place, the filter trench principle was also advised for a public latrine with success, and it seems to me by such adaptation economical latrines can be secured.

In the important matter of public water-supplies, beyond the completion of the Cocanada scheme, no advance has been made; nor does there seem any possibility of any town undertaking a scheme of any sanitary importance until Government is in a position to again offer grants-in-aid, which usually amounted to one-half the capital to be sunk. As an alternative, seeing that the financial condition of most municipal towns is sound, it seems to me it ought to be possible, by Councils putting their wants before English investors, to secure English capital on the security of taxes for investment. There is, of course, no lack of capital in this country that might be thus suitably invested, but the Indian capitalist's estimate of what is a fair return for his money is warped by his experience of the profit of money-lending.

With the advance of plague, it is probable that more attention will be given by municipalities to the condition of overcrowded localities than hitherto. Bad

examples of these are in Rajahmundry, Madura, Tinnevelly, Negapatam, Coimbatore and Ootacamund. Improvement schemes are in course of preparation in all these localities. Under Mr. Pears, the present President of the Municipal Commission, City of Madras, the subject is also receiving attention in respect to the notoriously insanitary locality known as the Tinnevelly Settlement.

During the year, Government undertook the amendment of the City of Madras Municipal Act. The introduction of several efficient sanitary clauses is contemplated.

Attached is the usual table (Appendix XI.), showing the results of completed sanitary works on public health. As to the six towns with protected water-supply, where distribution is fairly efficient, the following average figures are obtained :— For five years previous to the introduction of water-supply, the average cholera rate was 4·1; for the five years ending 1903 it was 1·4 and, during 1903, 1·3. The fever death-rate for five years prior to the introduction of water-supply was 8.9; in the five years ending 1903 it was 4·4, and in 1903, 3·6. The total death-rate for five years prior to introduction of water-supply was 30·4; for the five years ending 1903 it was 27, and in 1903 it was 27·6. Under these circumstances, I do not think there is any reason to doubt that the introduction of protected water-supplies (although not in a single instance in this Presidency can it be said that it has been so fully introduced into a town to the exclusion of other sources that its full benefits could be derived by the population) has been followed by a marked reduction in total mortality, and in the fever and cholera rates. In other parts of India, I am aware it is held that the introduction of water-supply into towns when unattended with a drainage system, as is the case in this Presidency, has been followed by an increase of the fever-rate, and it is of course no stretch of theory to ascribe exacerbation to better opportunities for propagation of the anopheles mosquitoes. However, statistics have continued now for some years past to teach the one lesson that, with the introduction of improved water sources in this Presidency, a diminution of fever-rate has followed. It has been long felt by the medical profession that there prevail amongst the people still imperfectly recognised forms of fever, and it is quite possible that certain of these are connected with the water-supply. For example, we know nothing of the real origin of the *Piroplasma Donovani*, and it may happen this may be proved to be connected with the water-supply, or that the theory that water-supply is connected with malarial fever has still truth in it, notwithstanding the clear demonstration that it is certainly capable of being propagated by transfer by mosquitoes from man to man. In respect to the fever-rate, it is worth remembering that there may be less inclination during the period of plague prevalence to register deaths to be due to "fever"; but how little this possibility need be taken into account can be judged by contrasting the conditions of towns where protected water-supplies have not been introduced. Here, we find that in 14 towns the average fever-rate for the five years ending 1898 was 6·7 and for the same period ending 1903 5·9; a reduction of ·9, against 4·5 in the case of the towns supplied with water. Moreover, the total mortality, far from being reduced, rose from 29·4 to 30·0. Although, therefore, I think that the towns that are now supplied with water by no means have obtained the maximum benefit they should secure for the money they have spent, were they to arrange for more perfect distribution and for the closing of all promiscuous water sources, it seems to me evident that the populations in decreased mortality are already reaping the benefit that should compensate for the inconvenience caused by increased taxation. There is, I believe, room for reform in the matter of supplying houses with water. It is rarely necessary for native houses on account of a climate of the character of the South of India, or on account of caste, to require distribution of the water in private premises beyond the reach of ready inspection. When distribution of this nature is necessary, it should be paid for as a luxury, and thus both economy of water and its purity would be controlled better than at present. Unfortunately, no real effort to secure economy of water by Councils seems to be made beyond shutting off the water supply for a certain number of hours daily—thus causing all the danger of intermittent supplies. Beyond the Cocanada water-works already referred to, which were opened in July, 1903, no new major sanitary works were completed during the year.

District Boards.—I regret I have nothing to record as to advance by District Boards that would appeal to the average sanitarian. The people under the administration of these Boards number 34,598,644 against 2,406,455 in municipalities.

The total income of these Boards (1902-03) amounted to £643,817. Of this amount, if the total income after meeting "plague charges" be regarded as that solely available, 5·4 was spent on sanitation, as contrasted with 7·2 per cent. on education (irrespective of £141,627* from Provincial Funds) and 8·5 on medical services. In the midst of a population larger than that of England and Wales, the expenditure in obtaining new sources of water-supply, which are certainly most urgently required, amounted to ·1 pie per head. In not a single village, up to date, is there any pretence towards public water-supplies delivered in protected pipes by lifting or by gravitation, after modern methods. Aeromotors and kerosine oil engines are, at the present time, cheap, and require but modest skill for their use, whilst the possibility of landing pipes in rural parts by rail and canal is now infinitely better than 30 years back; yet, District Boards continue to forget that to protect their water-supplies by less crude methods than at that period might reasonably be expected of them. The remainder of the 5·3 per cent. of the total funds was spent in *repairing* old wells and tanks, in conserving 399 unions and 140 villages, and in the sanitation of fairs and festivals. The absence of new sanitary works to which I have invited attention is in the main due to the Cinderella share that sanitation receives from the income of Boards, but also to the absence of officers who have the time to devote to not only suggesting but drawing up the main outlines of simple schemes. Much may be hoped for in the future in initiating small and useful sanitary schemes, by Government having sanctioned the employment of District Health Officers of the Assistant Surgeon Class (G.O., No. 1558 L., dated 7th December, 1903). These men, I have recently proposed to Government, should be required to take the "Licentiate of Sanitary Science" degree of the University of Madras. They would be aided by competent engineering subordinates. The appointments now sanctioned form an important link in the scheme some years back placed by me for consideration before Government in which Vaccination, Sanitation and Registration of rural areas were placed under the administration of a single Sanitary Department (G.O., No. 435, Public, dated 17th April, 1897). All hopes of such an advance have, however, been aborted by Government which had hitherto fostered the growth of a movement to supply the Presidency with Certificated Sanitary Inspectors suddenly forbidding their use in rural areas in permanent posts, on the ground that their employment "with a roving commission to point out sanitary defects in villages would be attended with grave danger," and that "their right to recommend or report would furnish a powerful weapon for misconduct" (G.O., No. 1131 L., dated 11th September, 1903). Although the same Order secured an improvement in the education of Sanitary Inspectors by giving them a course in Sanitary Engineering, the conditions brought about by it are such as to react generally upon sanitary advance in rural areas. Not only has this Order operated in this manner, but it will undoubtedly greatly limit the outturn of Sanitary Inspectors. It has already rendered the supply of certificated men for plague duty a matter of difficulty.

---

* This is the figure for 1901–02.

ABSTRACT OF THE REPORT OF THE SANITARY COMMISSIONER FOR BOMBAY, FOR 1903.

(*Lieutenant-Colonel O. H. Channer, I.M.S.*)

General Population.

European and Eurasian Vital Statistics.

The European Census population of 1901 in the Bombay Presidency, exclusive of cantonments in quasi-foreign territory, is 18,804. During the year 1903, 270 births and 253 deaths were recorded against 251 and 302, respectively, in 1902. The birth-ratio was 14·36 as against 13·35 in 1902, the death-ratio 13·45 as against 16·06 in 1902. By sexes 132 males and 138 females were born against 133 and 118 in 1902. And as regards deaths 148 males and 105 females died against 189 and 113 in 1902.

The Eurasian Census population of 1901 is 6,557. During the year 139 births were registered against 140 in 1902, and 160 deaths against 154, the birth-ratios being 21·20 per 1,000 against 21·35 in 1902, and the death-ratios 24·40 against 23·49. Of those born 63 were males and 76 females against 68 and 72 in 1902. As regards deaths 82 males and 78 females died against 84 and 70 in 1902.

Native Population—Vital Statistics.

Births.—In the Presidency of Bombay, including Sind, during the year 1903, there were 576,949 births registered against 631,393 in 1902, less by 54,444 than the number registered in the previous year and also less by 42,231 than the decennial mean ending 1902. In only six districts, Thána, Kolába, Ratnágiri, Sukkur, Panch, Maháls and Upper Sind Frontier, did the number of births exceed the deaths. The recorded birth-rate for the year was 31·22 per 1,000 against 34·16 in 1902 and a decennial mean of 32·98. The number of births recorded during the year is less in every Collectorate than in the previous year except in Belgaum, Dhárwár, Bijápur and the Upper Sind Frontier.

There were 299,485 male and 277,464 female births recorded during the year against 327,549 and 303,844 in 1902. For every 100 female births there were 107·94 male, which results compared with those of European countries is encouraging as denoting considerable accuracy in the registration of the sexes. There is a tendency, however, to slightly favour the males.

The following statement shows the number of births recorded in each year since 1893:—

Year.	Number of Births.	Year.	Number of Births.	Year.	Number of Births.
1893	664,305	1897	629,693	1901	465,647
1894	660,268	1898	582,371	1902	631,393
1895	674,304	1899	685,348	1903	576,949
1896	691,847	1900	505,662		

Since 1896 these figures show the effects of the havoc caused by plague and famine.

Fecundity was highest in November, lowest in February. In 1902 it was highest in October and lowest in February, whilst for the decennial 1893 to 1902 the maximum fecundity shows October to be the favourable month and February the lowest.

The recorded birth-rates among the urban and rural populations of the Presidency were 23·56 and 32·37 against 27·09 and 35·23 in 1902. Except in the Collectorates of Dhárwár, Kánara and throughout Sind, except the Upper Sind Frontier, the rural birth-rates exceeded the urban. In Dhárwár and the Upper Sind Frontier the birth-rates were nearly the same, viz., 31·12 and 22·93, respectively, in the rural and 31·94 and 22·10 in the urban. The urban rates in the collectorates of Násik, Ahmednagar, Poona, Sholápur, Ratnágiri, Thar and Párkar are all below 17 per 1,000 whilst in Sind both urban and rural rates are extremely low with the exception of urban Karáchi where births are very well recorded (44·35) and urban Sukkur (37·46). The mortality of women at a child-bearing age from plague and the havoc caused by that disease especially amongst the urban populations together with the scattering of the population outside towns and villages, both lowered the birth-rates and made registration often extremely difficult.

Out of 56 towns and 7 cantonments in the Presidency 3 towns recorded a birth-rate exceeding 40 per 1,000, viz., Karáchi (44·35), Sukkur (40·01) and Borsad (42·07). Eleven towns returned rates between 30 and 40, 28 between 20 and 30, and the remainder 14 towns and 7 cantonments below 20. Whilst plague created great disturbance in the correct registration of births, municipalities have much work before them before their birth returns can be accepted as accurate. The municipalities of Karáchi, Sukkur and Borsad are to be congratulated on the care with which they have carried out their duties.

Deaths.—Among the native population in the rural, town and cantonment circles in the Presidency 811,525 deaths were registered in 1903 as against 721,462 or 90,063 more than in 1902. Of the total deaths no less than 281,269 or 34·66 per cent. were due to plague. Of the total deaths registered 413,783 occurred among males and 397,742 among females against 369,491 and 351,971, respectively, in 1902.

The following statement shows the number of deaths recorded in each year since 1893:—

Year.	Number of Deaths.	Year.	Number of Deaths.	Year.	Number of Deaths.
1893	511,831	1897	749,916	1901	686,134
1894	607,179	1898	548,825	1902	721,462
1895	538,540	1899	672,269	1903	811,525
1896	596,472	1900	1,318,783		

Death-rate.—The death-rate reached the very high proportion of 43·91 per 1,000 and rose above that of 1902 by 4·87.

The rate per 1,000 of males dying to males living was 43·42 and of females dying to females living 44·43. In 1902 these ratios were 38·77 and 39·32, respectively. For every 100 female deaths there were 104·03 of males, but these proportions vary considerably, as in Bombay City the ratio of males to female deaths was 133·79, in Karáchi Collectorate 120·27 and in Násik 105·72.

In the Western, Central, Southern, Gujarát and Sind Registration Districts the number of deaths recorded in 1903 were 192,649, 217,255, 207,903, 124,652 and 69,066, and their ratios per 1,000 were 43·60, 44·70, 63·10, 46·15 and 21·54, respectively. Excluding Sind the ratios were greatly inflated by plague, 18·39 per 1,000 of population being destroyed in the Central, 32·85 in the Southern, 11·16 in Gujarát and 11·50 in the Western Registration District.

Excessive death-rates were recorded in all collectorates excepting those of Sind, and Panch Maháls and Ratnágiri and ranged from 74·53 per 1,000 in Belgaum to 29·38 per 1,000 in Kolába. 14 out of the 19 collectorates of the Presidency proper recorded rates over 40 per 1,000. The exceptionally low death-rates recorded in

the Thar and Párkar and Upper Sind Frontier Collectorates, 17.95 and 15.19, respectively, point to defective registration.

As regards deaths by ages there were 220,404 deaths of children under 5 years of age which, according to the census of 1901, gives the high death-rate of 97·04 per 1,000 on the population under 5 years. The children under five contributed 27·16 per cent. to the total deaths. The deaths of adults, 20-30 years of age, were also excessive. The influence of the destructive plague epidemic during the year is seen throughout the mortality exhibited in this table.

The mortality was excessive for the whole Presidency in both sexes, viz., 219·57 and 206·70 per 1,000 births, respectively, and may be ascribed in great measure to bad sanitary arrangements and those special agencies which destroy infant life and which vary in different localities. Some of the principal causes are improper and insufficient food, bad management, use of opiates, neglect, early marriages and debility of mothers. The widespread influence of plague struck severely both mothers and infants. All districts show abnormal rates except Ratnágiri, the Panch Mahál and the Upper Sind Frontier where the mortality was recorded as below 150 per 1,000 births. In the remaining Collectorates, excluding Bombay, the rates reach as high as 301·09 male and 288·97 female in Broach to 162·88 male and 141·15 female in Bijápur. In Bombay City the ratios returned each 547·48 and 527·57, respectively. The causes of the apparent excessive mortality of infants in Bombay City and Ahmedabad were specially reported on in accordance with Government Resolution No. 3184, dated 19th June, 1903.

Deaths by causes.—The subjoined table shows the deaths in 1903 arranged according to causes and contrasted with the results for 1902 and with the mean of the preceding five years:—

Causes of deaths.	Mean for 5 years, 1898–1902.		1902.		1903.	
	Number.	Ratio per 1,000 of population.	Number.	Ratio per 1,000 of population.	Number.	Ratio per 1,000 of population.
Cholera	38,733	2·07	3,229	·17	1,825	·09
Small-pox	4,239	·23	2,189	·12	2,732	·15
Plague	105,799	5·66	184,752	10·00	281,269	15·22
Fevers	310,175	16·60	270,845	14·66	259,704	14·05
Dysentery and diarrhœa ...	93,730	5·02	58,682	3·17	55,443	3·00
Respiratory diseases	—	—	59,379	3·21	59,349	3·21
Injuries	7,367	·39	7,434	·40	6,693	·37
Other causes	229,452	12·28	134,952	7·30	144,510	7·82
All causes	789,495	42·25	721,462	39·04	811,525	43·91

The maximum mortality (92,785) occurred in January and the minimum (38,803) in June. In 1902 the maximum and minimum occurred in December and June, respectively (85,005) and (34,462).

The recorded death-rates among the urban and rural population were, respectively, 59·87 and 41·51 per 1,000 as against 60·22 and 35·85 in 1902. Only in six collectorates out of 25 were the rural death-rates in excess of the urban.

Chief Diseases.

Cholera.—In the year 1903 there were 1,825 deaths recorded as due to cholera compared with 3,229 in 1902. The disease was practically confined to Sind where

there was a slight but distinct epidemic. In nine districts in the Presidency proper only 73 deaths were recorded. The epidemic which last year caused 3,229 deaths was also practically confined to Sind which bore 95·41 per cent. of the total cholera mortality. In the year under report, 96·00 per cent. of the mortality likewise occurred in this province, whilst nine districts recorded the remaining deaths.

During the first four months of the year, the disease was absent from the whole Presidency excepting in Bombay City (5 deaths) and a single death recorded from Broach Town. From May to October the cholera poison became active in Sind alone, and was chiefly confined to the Sukkur, Lárkhána and Upper Sind Frontier Districts. In the terrific heats of June, July and August the disease was at its worst, destroying 1,141 persons or 65·12 per cent. of the total mortality during the epidemic.

There is a distinct relation between cholera and seasons. In the rainless province of Sind the seasons differ from those of the Presidency in their excessive high temperatures in the hot months and the very great alternations in the cold. The air is very dry. In the epidemic which occurred in Sind, the disease was active from May to October and was at its maximum during the hottest months of this period—June—August. In the epidemic of 1902 it showed the same seasonal prevalence.

The following table shows the total number of deaths from cholera in each of the twenty-one years ending 1903:—

Year.	Number of deaths.	Year.	Number of deaths.	Year.	Number of deaths.
1883	37,954	1890	3,259	1897	57,109
1884	13,804	1891	17,850	1898	4,368
1885	37,287	1892	42,900	1899	8,579
1886	167	1893	18,853	1900	163,889
1887	25,711	1894	33,588	1901	13,600
1888	36,500	1895	8,890	1902	3,229
1889	32,431	1896	35,404	1903	1,825

This record shows that cholera is indeed endemic in the Presidency lighting up into epidemic lasting generally three years. If the deaths are multiplied by 2 on the assumption of the general cholera mortality being 50 per cent., some idea may be formed of the terrible amount of sickness and suffering caused by this disease.

Fifty-two per cent. of the collectorates returned cases, but in only three districts of Sind, viz., Sukkur, Lárkhána and Upper Sind Frontier was the disease epidemic. Karáchi, which recorded an outbreak destroying 4·47 per 1,000 of population last year was entirely free in 1903. The mortality in Sukkur was 1·24, in Lárkhána 1·39 and in the Upper Sind Frontier 0·56 per 1,000 of population.

Out of 56 town circles in the Presidency, 10 were affected by cholera against 8 last year. The disease was trivial in Belgaum, Nagar, Bijápur and Broach with a single death in each. Poona returned but 2 deaths, whilst Bombay City was particularly free from the disease with only 17 deaths. The chief mortality occurred in Shikárpur (2·30), Sukkur (2·65), Lárkhána (2·54) and Jacobabad (3·08) per 1,000 of population.

No cholera occurred in any of the 7 cantonments in the Presidency.

The disease was very local, attacking but 160 out of 25,846 villages in the whole Presidency, and of these, 152 or 95 per cent. were in Sind.

Small-pox.—There were 2,732 deaths from small-pox (1,488 males and 1,244 females) against 2,189 in 1902 and a decennial mean of 4,049. Of the 2,732 deaths, 1,460 or 53·44 per cent. were contributed by the city of Bombay. The total mortality was considerably below the mean. Assuming amongst the vaccinated and unvaccinated 30 attacks to each death, there were some 81,960 persons attacked from the disease during the year. The highest mortality occurred in the city of Bombay with 1,460 deaths. The Western Registration District contributed 734, the Central 203, the Southern 53, Gujarát 53 and Sind 229. The disease was conspicuous in the

Hyderabad, Ratnágiri, Kolába, Násik and Khándesh Districts. In the year under report 29·87 per cent. of deaths occurred among children under 1 year of age, 39·60 among children 1-10 years old, while the remaining 30·53 per cent. took place among persons over 10 years of age.

The disease is endemic. The figures of previous years show the destruction caused year by year by this essentially preventable disease. As an instance of the difficulty in preventing the spread of the disease, the Deputy Sanitary Commissioner, Sind, observes: "There being no jurisdiction over the movements of infected persons either by road or boat the disease is carried from one circle to another in the province. In a particularly severe outbreak in the town of Málegaon, Western Registration District, the Deputy Sanitary Commissioner draws attention to the opposition to vaccination on the part of a class of local Momins, weavers, and the difficulty in obtaining early notification of the disease from neglect on the part of the people in reporting cases to the town authorities. The spread of the disease in Málegaon was mainly due to this cause and the opposition of the Momin weavers.

The Deputy Sanitary Commissioner, Southern Registration District, observes: "Parents in the jungle districts of Kánara and Dhárwár object most strongly to vaccination especially of infants under 1 year of age, thus many children escape vaccination permanently."

The preventive measures adopted in all outbreaks were those habitually adopted by the Department, viz.:

On the notification of outbreaks, vaccination and revaccination is offered to the people and as much vaccination work performed in and around the affected area as possible. Isolation and disinfection methods are at present impracticable. Owing to notification being non-compulsory frequently the only intimation received by the Deputy Sanitary Commissioner is the return of deaths from small-pox, by which time the disease has obtained a firm hold on the village. In the Málegaon outbreak above referred to, the Deputy Sanitary Commissioner states on visiting the town he found that "for the most part only fatal cases had been reported." The only remedy of any use in dealing with small-pox is the gradual introduction of compulsory vaccination and registration with compulsory notification of cases, all other methods are merely palliative.

Fever.—There were 259,704 deaths registered under the heading "Fever" (134,048 males and 125,656 females) against 270,845 in the last year and a decennial mean of 354,577. The total fever death-rate for the whole Presidency was 14·05 per 1,000 as compared with 14·66 last year, and the decennial mean of 18·91 per 1,000. The highest mortality from fevers was recorded in Ahmedabad (31·19), Broach (24·83), Lárkhána (21·51) and Surat (18·14). All the districts in Gujarát and Sind (except Sukkur) and the collectorates of Khándesh, Poona, Sholápur, Kánara and the city of Bombay recorded lower rates than last year. The remaining districts showed higher rates—Násik excepted, in which they are equal. The number of deaths returned as due to fevers was highest in January and lowest in June. They rose steadily from August to January and gradually fell from 24,045 in March to 15,773 in July.

In accordance with the Army Sanitary Commission's memorandum on the Sanitary Commissioner's Report for 1901, paragraph 1, a brief account is given of the measures carried on in dealing with "Malarial Fevers." The Deputy Sanitary Commissioner, Southern Registration District, remarks "Malaria is especially ripe in the forest areas of Kánara and Dhárwár. The Collector states the population in these areas is gradually diminishing." Captain Hutchinson mentions quinine is at present issued at dispensaries and post offices and also by Circle Inspectors, and now travelling dispensaries have been sanctioned for the most malarious areas in Kánara. An attempt at the reduction of mosquitoes in the forest areas he considers impracticable. In Bijápur Town Captain Hooton, Civil Surgeon, organised mosquito brigades with good effect especially in the vicinity of the Jail. Londa, Belgaum and other places were being dealt with in a similar manner. In Násik, Lieut.-Colonel Anderson, Deputy Sanitary Commissioner, obtained encouraging results from the destruction of the breeding ground of anopheles, and as long as he could be present the work was energetically carried out.

Plague.—During the year 1903, 281,269 deaths (141,559 males and 139,710 females) were recorded from plague, being an increase of 96,517 compared with the previous year.

The number of deaths ascribed to plague in each year since 1896 is as follows:—

Year.	Number of deaths from Plague.	Year.	Number of deaths from Plague.
1896	2,086	1900	33,196
1897	46,944	1901	128,259
1898	86,191	1902	184,752
1899	96,596	1903	281,269
Total	231,817	Total	627,476
Mean	57,954	Mean	156,869

As will be seen from the table the disease was extremely fatal in 1903 destroying over a quarter of a million persons. The mortality was the highest experienced since the commencement of the disease in 1896 and affected all districts more or less except Thar and Párkar and the Upper Sind Frontier.

Excessive mortality fell on the collectorates of Belgaum and Dhárwár. No less than 92,043 or 32·72 per cent. of the total plague mortality occurred in these ill-fated zillahs. 222 or 78·44 per cent. Registration Circles were attacked. Excluding Sind the percentage was 93·75. The rates per 1,000 of population for the different Registration Districts were as follows:—Southern, 32·85; Western, 11·50; Central, 18·39; Gujárat, 11·16; and Sind, ·85.

The disease, which rose steadily last year from July, continued severe through the first quarter of 1903, when the mortality fell from 32,188 in March to 17,571 in April. Through May and June the mortality showed marked decline and thence onwards steadily increased to October gradually falling in November and December. In both 1902 and 1903 the mortality from plague have been the highest on record. In both years there was the same remarkable fall in the deaths during May and June.

Notwithstanding the widespread and fatal character of this scourge only 18·27 per cent. of towns and villages were affected as against 10·38 per cent. last year.

The general rates were markedly affected by plague in the districts of Khándesh, Násik, Ahmednagar, Poona, Sholápur, Sátára, Surat, Kaira and all the districts of the Southern Registration District except Kánara. In the towns plague was the cause of over half the general mortality in Nasirabad, Yeola, Ahmednagar, Poona, Sholápur, Sátára and Karád and in the remaining towns greatly raised the general death-rates.

Dysentery and Diarrhœa.—Dysentery and Diarrhœa caused the deaths of 29,586 males and 25,857 females, or a total of 55,443 persons as against 58,682 in 1902 and a decennial mean of 69,364.

The deaths ascribed to dysentery and diarrhœa which were so numerous during the famine years, notably in 1900 when the mortality was 218,243, fell to 55,443 in 1903. The causes of the high annual mortality from dysentery and diarrhœa must be ascribed chiefly to impure water-supplies, poverty, privation, unwholesome food, dust, flies, and lack of skilful medical attendance. Travelling dispensaries would do much to lessen the high mortality from these diseases.

The Deputy Sanitary Commissioner, Gujarát Registration District, remarks: "Strict attention to the purity of the drinking water-supplies is the chief prophylactic to apply to the prevention of these diseases. As far as I have observed during the short period I have been in Gujarát, but little attention is paid to prevent contamination of drinking water-supplies, practically no attention being paid to the recommendations of the Sanitary Department on the subject."

The mortality was highest in the Western Registration District, 5·30 per 1,000, and lowest in Sind, ·18. The Central returned a ratio of 4·35, the Southern 2·59 and Gujarát ·65 per 1,000.

Injuries.—During 1903, 3,723 males and 2,970 females met with violent deaths against 4,107 males and 3,327 females last year. The mortality from these causes was the lowest since 1897. Of the 6,693 deaths, 3,040 occurred from drowning, 1,074 from snake bite, 828 from wounding, 172 from hanging, 132 from poisoning, and 79 from attacks by wild beasts.

Respiratory Diseases.—The total deaths from respiratory diseases amounted to 2·52 per 1,000, whilst in towns it was 7·83. High mortality rates were reported from the towns of Ahmednagar (15·54), Bombay City (9·30), and the Gujarát towns of Surat (17·79), Broach (19·69), Jambusar (25·23), Kaira (20·27), Nadiad (12·22), Borsad (10·54), Kapadvanj (13·44), Ahmedabad (10·50). Hyderabad (Sind) had the very high rate of 14·28 per 1,000. The returns from towns of Gujarát are unusually high, and if correct, would indicate a considerable amount of lung disease.

Other Causes.—The number of deaths recorded from "Other Causes" number 144,510 (71,953 males and 72,557 females) against 134,952 in 1902 and a decennial mean of 161,830. 17·87 of the total deaths were recorded under "Other Causes."

Sanitary Works.

During the year ending 31st March, 1903, there were 166 municipalities in the mofussil with a population of, according to the Census of 1901, 2,376,275 souls. The total net income of these municipalities amounted to £398,960, of which sum £106,042 was expended on improving water-supply, drainage and conservancy within municipal limits. The ravages of plague have embarrassed the financial position of most municipalities, and for want of funds many urgent schemes of water-supply and drainage have not been carried out.

There were 23 District Local Boards with 207 Táluka Local Boards; the entire income of these Boards during the year ending 31st March, 1903, amounted to £326,463, and out of this sum £15,718 was expended on water-supply and drainage.

The Bombay Village Sanitation Act, 1889, has been introduced into 265 villages against 294 up to the end of last year, this decrease being due to the abolition of 37 non-working committees in the Poona Collectorate as per Government Resolution, General Department, No. 6107 of 23rd November, 1903.

The number of selected villages in which "The Village Sanitary Inspection Book" has been introduced stands at 3,598; of which 1,818 or 51 per cent. have been written up by officers of the Sanitary Department.

The death-rates in all the towns enumerated have been greatly affected by plague, since the introduction of either water supplies, or drainage or both. To elucidate the effect of these sanitary measures, detailed inquiry and report is required for each town, especially with reference to fever and plague mortality.

General Remarks.

The widespread and destructive epidemic of plague in 1903 crippled many of the municipalities, and one cannot but have the deepest sympathy with the people of those towns which suffered so terribly from the pestilence. It was the most destructive plague year since 1896. Nevertheless, it is gratifying to note that the closing balance of the municipality in the Presidency was £98,440, and that the amount spent on public health and convenience was £182,440 or 40·74 per cent. of income and showed an increase of £21,024 over last year.

The extension of towns and villages over a larger area than at present is imperative. The extreme density of the population on the inhabited area and the insanitary conditions engendered thereby are patent causes of disease. It is no wonder, then, that the malignant plague bacillus has found the undefended and overcrowded population such an easy prey. The lesson to be learnt is obvious—the people must spread into suburbs and live more in the country and sooner or later land must be taken up for this purpose. Already in many towns the people are beginning to see the value of living in suburbs, as *e.g.*, in Bombay, Belgaum, Poona, &c.

The registration of vital and mortal statistics still remains defective in Sind, and many of the towns of the Presidency proper. Municipalities are timid in the

enforcements of by-laws. The vaccinators who are employed to check the birth and death registers and report omissions to their Deputy Sanitary Commissioner, for fear of offending and bringing to punishment the police patels who are the registrars, perform this duty in a very perfunctory manner. As the registrar is also the official upon whom the vaccinator depends for his success in vaccination work, it is obviously his interest to keep in with that official. Hence omissions in the birth and death registers are not to any extent reported by vaccinators.

Registration might be improved in dispensary towns if the work could be handed over to the Medical Officer, who should also be made Medical Officer of Health of town and grant medical certificates of the cause of death.

The high rates of "still-born" in the Bombay City, Ahmedabad and Kánara have from time to time attracted attention. No definition of "still-born" has ever been given as a guide to Registrars so far as I am aware. In Italy, Germany, and the four Scandinavian countries the term "still-born" is used in the medico-legal sense, *i.e.*, a viable infant (having had over six months of intra-uterine life, being 25 centimetres long) which is dead without having breathed. In this country the report of "still-born" is received generally second-hand by Registrars and in consequence the information is often inaccurate.

The inoculation of children with cow-pox from arm to arm is not always a very simple operation, especially with refractory children. When, as we know, blood is not infrequently mixed with the vaccine the necessity for maintaining a strict supervision over operation by Inspectors and Deputy Sanitary Commissioners must be conceded. It is hardly justifiable to perform the vaccination work without. In the Bombay Presidency and Sind there are but five Deputy Sanitary Commissioners to supervise the work amongst 25,424,235 persons covering an area of 188,745 square miles. Frequent changes in this staff must act detrimentally on the supervision of the work. Statistics show the necessity for continued effort in dealing with that highly infectious disease, small-pox, and any relaxation of supervision entails lax work on the part of vaccinators and an eventual increase of the disease.

"Sanitary Inspection Books" have been introduced into a large number of towns and villages, and the results are being watched with interest. Deputy Sanitary Commissioners have been requested to give as much time to them as possible. In Broach they have been introduced throughout the district. It appears to me these Inspection Books which take much time and care to write up, involving also a careful inspection of the locality, should be only introduced at first into the larger and more important towns and villages.

ABSTRACT OF THE REPORT OF THE HEALTH OFFICER OF THE PORT OF BOMBAY FOR THE YEAR ENDING 31ST DECEMBER, 1903.

Summary.—The following statement shows that during the year 14,597 vessels of all sorts, with 719,322 crew and passengers, were examined against 15,432 vessels, with 701,964 crew and passengers during the year preceding. The clothing and bedding of 96,188 crew and passengers of outgoing and incoming vessels were disinfected. Of this latter number 84,287 were native crew and third class or deck passengers and pilgrims who left the port of Bombay for ports out of India, and 11,901 were crew, troops, pilgrims and passengers who arrived by vessels on which cases of infectious diseases occurred or by ships from ports against which the inspection at Bombay was compulsory. Of the 11,901 persons as shown above 2,712 were crew and British troops who arrived by transports, 729 were crew and passengers from East African ports among whom cases of jigger were detected, 6,466 were pilgrims who returned from Mecca via Aden and other routes and whose clothing and bedding had to be disinfected in accordance with the orders of the Government of India, and the remaining 1,994 were crew and passengers of other inward vessels among whom cases of infectious diseases were detected. Fifty-five vessels on which cases of infectious diseases occurred were disinfected. Four hundred and fifty-eight persons among whom cases of small-pox occurred were vaccinated. At the outward and inward inspections and on board vessels lying in the harbour and docks, 77 cases of plague, two cases of cholera, 238 cases of small-pox, 19 cases of measles, 81 cases of chicken-pox, seven cases of jigger and one case of scarlatina were detected.

Statement showing the summary of the shipping of the Bombay Port and the work in connection therewith for the year ending 31st December, 1903:—

Vessels, including Country Craft.	Total Number of Vessels.	Number of Vessels inspected.	Number of Persons inspected, including crew on vessels.	Number of Native Crew and 3rd Class or deck passengers disinfected during the year.	Number of Vessels disinfected.	Number of Persons vaccinated.	Diseases and Number of Cases of each.							
							Plague.	Cholera.	Small-pox.	Measles.	Chicken-pox.	Jigger.	Leprosy.	Scarlatina.
Entered	*34,351	102	22,272	11,901	23	458	16	2	12	8	18	7	—	—
Left	*34,369	14,463	697,050	84,287	—		39	—	217	8	63	—	—	—
In harbour during the year.. ..	*1,172	32	—	—	32		22	—	9	3	—	—	—	1
Total for 1903	69,892	14,597	719,322	96,188	55	458	77	2	238	19	81	7	—	1
Total for 1902	69,791	15,432	701,964	93,479	61	252	44	2	11	106	67	30	—	1

* These figures are supplied by the Customs Department and the Port Officer, Bombay.

Incoming Vessels.—In accordance with the rules in force incoming vessels which were actually infected or suspected to be infected with plague, cholera, small-pox, measles, or other infectious diseases were inspected and disinfected on arrival at Bombay. In the case of all vessels arriving from East African ports medical inspection of their crew and passengers for the detection of jigger and sleeping sickness was carried out. One hundred and two vessels of all sorts with 7,912 crew and 14,360 passengers were inspected on arrival. Of the 102 vessels 23 entered the harbour with cases of infectious diseases on board. Five of the 23 infected vessels were hired transports which arrived from Southampton, Malta, Suez and Aden with a crew of 878 persons and 1,834 troops. One of the transports had two cases of plague, the second had three cases of small-pox, the third had two cases of chicken-pox, the fourth and fifth had seven cases of measles among the crew and troops. The plague-infected transport was the "Sátára" which arrived in February. One of

the saloon crew died of plague during the voyage. Another man was found on arrival to be suffering from fever. He was sent to the Modikhana Hospital where he developed plague. The vessel was infested with rats. On 25th February two dead rats were seen and five on the 27th under the stores on the main deck. The disinfection of the transports and of the clothing and bedding belonging to the crews and troops were carried out under the supervision of the Port Health Officer. Four vessels arrived with seven cases of jigger on board. The cases were removed to the Goculdas Tejpal Hospital for treatment. The jigger-infected vessels as well as the clothing and bedding of their crew and passengers, who numbered 729, were disinfected. One of the vessels was reported to have had eight deaths from plague during the voyage, and on arrival another case was sent to the Modikhana Plague Hospital for treatment. Four vessels which were reported to have landed at Karáchi 74 cases of jigger and to have undergone the necessary disinfection there were not treated as infected arrivals at Bombay although they were subject to medical examination on arrival. Thirteen vessels with 6,466 pilgrims arrived from Jeddah, four of which had seven cases of small-pox. The vessels were thoroughly disinfected. It was compulsory to disinfect the clothing and bedding of the returning pilgrims before they were made over to the Protector of Pilgrims for despatch to their homes in India and beyond the Indian frontier. The remaining 10 vessels with a total crew and passengers of 1,994 persons had on board five cases of plague, two cases of cholera, two cases of small-pox, one case of measles and 16 cases of chicken-pox. The vessels and the kit of the persons among whom the cases occurred were disinfected.

The ship which had 9 cases of plague on board was the S.S. "Khalif" which arrived in the Bombay harbour on the morning of 14th March from Zanzibar via Marmagoa. Her crew (65 in number) and passengers (2 cabin and 1 deck) were examined for jigger, but no cases of jigger were found among them. The Commander of the vessel reported that 8 persons (including the 3rd Officer and a deck passenger) had died on board the vessel during the voyage, and had been buried at sea, and also that one of the crew was ill on board. This man (a coal-trimmer) had been ill for 14 days. On examination in the forehold where he was isolated he was found to be suffering from fever and a bubo in the left femoral region. He was removed to the Modikhana Plague Hospital, where he was diagnosed to be suffering from plague. From the history of the eight persons who suffered from fever and enlargement of glands, and who died during the voyage, there is not the least doubt that they all died of plague. The first patient (3rd Officer) was attacked on the 27th February, and died on the 4th March. He used to give out stores daily from the store-room to the native crew. These eight deaths all occurred between the 4th and 11th March. On 20th February about 50 dead rats in all were found in the store-room and forehold by the officers of the ship. The ship on arrival in Bombay on 14th March had the decks, forecastle and latrines thoroughly disinfected with a solution of carbolic acid. The store-room and holds were fumigated by burning sulphur in them at the rate of 6 lbs. per 1,000 cubic feet of space. At the Captain's wish the provisions in the store-room to which the rats had access were destroyed. As the plague on the S.S. "Khalif" appeared to be due to infected rats or cargo a short report on the case was submitted to Government with this Office letter, No. 964, of 2nd April, 1903.

The vessels which arrived from East African ports were inspected with a view to detect cases of sleeping sickness as per Government Resolution No. 2969, of 28th May, 1902. Up to the present no case of that disease has been discovered here.

Outgoing vessels.—The medical examination of the crew and passengers of all vessels and the disinfection of the clothing and bedding of the Asiatic and African members of the crew, who were not officers, engineers, doctors, or Japanese, and of the deck, 3rd and 4th class passengers and Asiatic and African servants bound for ports out of India were carried out immediately before they left the Port of Bombay as laid down in the Medical Inspection Rules published under Government Notification No. 3892-P., dated the 14th June, 1899, and Rule I issued under Government Notification No. 2671-P., dated the 2nd October, 1902. The inspection of the crew and passengers was done by day, on shore, in sheds specially arranged for that purpose. The disinfection was carried out at the disinfection station on the Frere Road, near the Prince's Dock, or by means of the stove on the floating disinfection barge.

During the year under report 14,463 outward bound vessels with 237,995 crew and 459,055 passengers were inspected. Thirty-nine cases of plague, 217 cases of small-pox, eight cases of measles, and 63 cases of chicken-pox were detected.

Of the 14,463 outgoing vessels 461 vessels with a crew of 43,974 persons and 40,624 passengers left for Aden, or ports in the Red Sea and Europe; 320 vessels with 28,664 crew and 26,486 passengers for ports out of India; and the remaining 13,682 vessels with 165,357 crew and 391,945 passengers for Indian Ports including Burma.

The clothing, bedding and boxes and other suspected articles of 45,708 Asiatic and African members of the crew and of 34,121 3rd and 4th class and deck passengers and pilgrims who sailed on steamers bound for ports out of India were disinfected. In addition to this disinfection, the kits of 3,950 crew and 508 passengers who sailed in native craft for ports out of India were also disinfected. Thus the total number of outward bound crew and passengers whose clothing, bedding, &c., was disinfected comes to 84,287 during the year under report against 79,338 during the year preceding.

The disinfection of the clothing and bedding of the crew and passengers of vessels which proceeded to ports out of India via Karáchi was not carried out at Bombay, *vide* Government Resolution, General Department (Plague), No. 1210-P., dated the 7th April, 1902, as the agents preferred to have the disinfection done at Karáchi.

An apparatus for the disinfection by means of formaldehyde gas of boots and shoes of crew and passengers of vessels was supplied by the Director-in-Chief, Plague Research Laboratory. The apparatus is capable of taking 72 pairs of country shoes at one charge and requires 25 minutes for "ordinary" disinfection and 90 minutes for "absolute" disinfection. It takes close on three hours for the "ordinary" disinfection and nine hours for the "absolute" disinfection of 350 pairs of boots and shoes of the native crew of a large ship. As it is difficult to give this much time to the disinfection of boots from one ship the purchase of another boot and shoe disinfector of an improved pattern and of at least double the capacity of the present one has been suggested to Government.

It was found by Professor Haffkine that plague microbes ceased to grow in an appropriate artificial medicine after having been subjected for 25 minutes to formaldehyde gas derived from five paraform tabloids, but that they had still vitality left to enable them to recover their primitive vigour when injected into the body of a rat. In order to efficiently devitalize the plague bacillus and render it incapable of growing in the body of a very susceptible animal, it was found necessary to increase the paraform tabloids to 60 and the time of exposure to one and a half hours.

The crew and passengers of five vessels which called at this port merely to land or embark passengers were exempt from inspection and disinfection in accordance with the proviso to Rule I of the Medical Inspection Rules. Such of the crew and passengers as embarked at Bombay on the vessels were inspected by day on shore; the new native crew and 3rd and 4th class and deck passengers had their effects disinfected.

The Agents, Commanders, and Nacodas of all outgoing vessels, including native sailing craft, with the exception of a very few, were careful in paying attention to the sanitary state of their ships, and in almost all cases they have cheerfully carried out the instructions and advice of the Port Health Officer. The forecastles were limewashed, painted or disinfected before departure. The bilges of native sailing craft were generally clean at the time of inspection. Those that were found to be dirty or to contain foul water had to postpone their departures until they were thoroughly cleaned.

Seventeen vessels had cases of infectious diseases among their crew and passengers within 10 days prior to their departure from this port. The Bills of Health granted to these vessels mentioned the illness which occurred on board, and the measures which had been taken before departure for the prevention of the spread of the disease. Six vessels were allowed to convey to Europe and the Persian Gulf coffins containing the remains of certain persons who were certified to have died of non-infectious disease. The persons interested had the permission of the Governments of their country to convey the corpses.

An enquiry was addressed to the Bombay shipping Agents as to whether any of their steamers which were in possession of the Bombay Bill of Health met with any vexatious delay owing to quarantine regulations at foreign ports. All the

Agents, with the exception of the Agent, Austrian Lloyd's Steam Navigation Company, the Agent, German East Africa Line, and the Agent, Bombay and Persia Steam Navigation Company, Limited, report that none of their steamers were delayed at other ports.

Infectious Diseases on Vessels in the Harbour and Docks.—During the year under report 32 vessels, including native sailing craft which were lying at different berths in the Victoria and Prince's Docks and at the various banders in the harbour, had on board 20 cases of plague, of whom 19 died, nine cases of small-pox, and three cases of measles. In addition to these cases two persons (dock labourers) were found dead at certain wharfs in the Prince's and Victoria Docks. The cause of death in these cases was attributed to plague. All these vessels and those mentioned in the third paragraph of this report, as well as the places where the coolies were found dead, were thoroughly disinfected in accordance with the Regulations issued under the Venice Sanitary Convention and the Indian Ports Act.

The following table includes all steamers, square-rigged vessels and native craft which became infected while lying in the Port of Bombay during the year 1903:—

Months.	Number of Persons who were attacked with Plague at Bandars and in the Docks.		Total Number of Cases of Infectious Diseases in the Bombay Harbour.															
			Total Number of infected Vessels.	Cholera.		Small-pox.		Measles.		Chicken-pox.		Plague.		Enteric Fever.		Scarlatina.	
	Cases.	Deaths.		Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
1903.																	
January ...	—	—	1	—	—	—	—	—	—	—	—	1	1	—	—	—	—
February ...	1	1	6	—	—	1	—	2	—	—	—	6	5	—	—	—	—
March ...	—	—	5	—	—	2	—	1	—	—	—	2	2	—	—	—	—
April ...	1	1	9	—	—	3	—	—	—	—	—	5	4	—	—	—	—
May	—	—	1	—	—	1	—	—	—	—	—	—	—	—	—	—	—
June ...	—	—	2	—	—	1	—	—	—	—	—	—	—	—	—	1	—
July ...	—	—	2	—	—	1	—	—	—	—	—	—	—	1	—	—	—
August ...	—	—	1	—	—	—	—	—	—	—	—	1	1	—	—	—	—
September ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
October ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
November ...	—	—	3	—	—	—	—	—	—	—	—	3	3	—	—	—	—
December ...	—	—	2	—	—	—	—	—	—	—	—	2	2	—	—	—	—
Total for 1903			32	—	—	9	—	3	—	—	—	20	18	1	—	1	—
Total for 1902			21	2	2	—	—	4	—	5	—	15	14	—	—	1	—

Port Observation Camp.—The area of land which was occupied by the camp was reduced on 1st June, 1903, from 12,555 square feet to 10,854 square feet, the monthly rent for which amounts to Rs. 75-15-8. This camp received some of the persons who were rejected, and sent there from the outward and inward inspections. They were kept under observation until their temperature fell to normal or until it was certain that the symptoms from which they suffered were not due to plague. Among the passengers and crew who were sent to the camp from the outward inspections, 39 developed plague and were transferred to the Modikhana Hospital for treatment. The sheds of the camp in which the plague cases developed were thoroughly disinfected with perchloride of mercury, and were kept unoccupied for some days. One hospital assistant and one ayah were employed to look after the inmates of the camp. The sweeping of the camp was done under arrangements made with the Public Health Department of the Bombay Municipality. The lime-washing of the sheds, floors, &c., and the general repairs to the camp were carried

out by the Executive Engineer, Bombay Presidency. One of the Senior Medical Officers was detailed in turn every fortnight to supervise the general working of the camp.

One of the sweepers in the Port Health Camp was sent to the Modikhana Hospital suffering from plague. He died in the hospital two days after admission.

Disinfection of Ships and Infected Cargo.—The total number of infected vessels of all sorts disinfected under the personal supervision of the Port Health Officer or of his staff was 55 during the year. In certain cases the disinfection barge was placed at the disposal of the Royal Navy and Royal Indian Marine Authorities for carrying out the disinfection of linen, mattresses and the clothing and bedding of the crew belonging to infected Naval and Indian Marine ships or transports on board of which were diseases which, although infectious, did not come under the infectious diseases mentioned in notification issued under the Indian Ports Act.

The vessel on which a case of cholera occurred had the drinking water on board discharged into the sea. The water tanks were thoroughly disinfected inside with potassium permanganate solution before they were refilled with a fresh supply of drinking water.

General Health of the Shipping.—During the year 867 persons connected with the shipping were admitted into the various hospitals in the city. The St. George's Hospital admitted 439 European patients, of whom 19 died, 404 discharged cured, and 19 remained after 1st January, 1904, under treatment. The Jamsetjee Jeejeebhoy Hospital admitted 142 Native patients, of whom 19 died, and the Goculdas Tejpal Hospital 286 Natives, of whom 25 died.

No deaths occurred from the effects of cleaning bilges of ships during the year. There were 235 accidents and 28 deaths due to accidents on board of ships which were lying in the harbour and docks. It appears that there is no Employers' Liability Act in India.

Red Sea Pilgrim Traffic.—Outward Pilgrim Traffic.—In the last year's report the number of pilgrims who sailed between the date, viz., 1st December, 1902, on which the camps at Pir Pao were opened, and the date, viz., 31st December, 1902, on which the year ended, was mentioned. The ships which sailed with pilgrims for Jeddah between 1st of January, 1903, and 6th February, 1903—the date on which the camps were closed—were as follows:—

S.S.	"Simla"	left with	391	pilgrims on	16th January,	1903.
,,	"Hooseinee"	,,	408	,,	20th ,,	
,,	"Haidari"	,,	501	,,	22nd ,,	
,,	"Kilwa"	,,	364	,,	29th ,,	
,,	"Gulf of Trinidad"	,,	552	,,	4th February,	1903.
,,	"Shahnoor"	,,	405	,,	6th ,,	
			2,621			

As a special report of the pilgrim traffic for the period extending from 17th October, 1903, to 30th January, 1904, has been forwarded to Government, it is considered not necessary to repeat in this report all the matters therein dealt with. During that period—17th October, 1903, to 30th January, 1904—16,401 pilgrims were segregated for 10 days in the camps specially erected for that purpose at Pir Pao, in accordance with Government Notification, No. 5282, dated the 7th October, 1903. This number does not include Her Highness the Begum of Bhopal and party comprising 305 persons who left in the S.S. "Akbar" on 30th October, as they were not segregated in Bombay. They had been segregated at Bhopal. During segregation 17 pilgrims died in the camp hospitals. The death-rate among so large a number of pilgrims while undergoing segregation is very low, more especially when it is taken into account that many of them were old and feeble.

Between 17th October, 1903, the date on which the camps were opened, and 31st December, 1903, the date for which this report is prepared, 13 vessels left for Jeddah with 8,300 pilgrims, and between 1st January to 30th January, 1904, 11 vessels left for Jeddah with 8,347 pilgrims. The number of vessels and the number of pilgrims which they conveyed to Jeddah during the pilgrim season of 1903-04 is 24 and 16,647, respectively.

During the pilgrim season many Mahomedans left for Aden as "shopkeepers" and for Suez as "travellers" and "merchants." The most of these people were undoubtedly pilgrims, and the Venice Convention lays down that pilgrims shall be segregated before being allowed to leave an infected country. Shipowners complained that they were not able to get many saloon pilgrims for their ships, as many of the Mahomedans who left for Aden and Suez were well-to-do passengers and would, if they had undergone segregation, go as saloon passengers by the pilgrim ships.

During the pilgrim season and while Mahomedan passengers were leaving by ordinary ships for Aden and Suez, the agents of a certain ship stated that they intended to take from Bombay without segregation 300 Mahomedan passengers for Suez, as that port does not come under the Pilgrim Ships Act, *vide* Notification (2), Section 5 of the Act. However, the idea was not carried out.

Inward Pilgrim Traffic.—Thirteen vessels brought to Bombay 6,466 pilgrims from Mecca viâ Aden and other routes. Four pilgrim ships arrived in Bombay with seven cases of small-pox. The baggage of these returning pilgrims was disinfected at the disinfection shed near the Prince's Dock. Pilgrims whose homes were up-country or beyond the frontier were not allowed to enter the town. They were made over to the Protector of Pilgrims for despatch direct from the disinfection shed to their homes by rail.

Sanitary State of the Harbour and Foreshore.—The sanitary state of the harbour and of the various bandars, basins and docks has been fairly satisfactory.

Cholera, Small-pox, and Plague in the City of Bombay.—During the year 17 deaths from cholera, 1,477 deaths from small-pox, and 20,788 deaths from plague occurred in the City of Bombay against 75 deaths from cholera, 288 deaths from small-pox, and 13,820 deaths from plague during the year preceding. The city was free from cholera in an epidemic form during the year. There was a heavy mortality from small-pox in February, March, April, and May. Plague raged as a virulent epidemic from January to May inclusive.

Whenever plague developed among the crew or passengers who were not allowed to sail on a vessel for ports out of India, Government were informed of the fact in order that the authorities at the vessel's next port of call may be made acquainted of the occurrence by wire. When a plague case occurred among those who were prevented from sailing on vessels bound for Indian ports, the Port Health Officer communicated the fact to the authorities at the next port at which the vessel was intended to touch.

There is a Clayton's apparatus in this port for the disinfection of ships' holds and for the destruction of rats and cockroaches on board vessels by means of sulphur dioxide. The apparatus belongs to one of the shipping firms in Bombay and is used by them in the disinfection of their steamers when necessary.

ABSTRACT OF THE REPORT OF THE CALCUTTA MUNICIPALITY FOR 1903-1904.

(*R. T. Greer, Esq., Chairman.*)

Suburban Sewerage Scheme.—Substantial progress has been made in the execution of this scheme which is estimated to cost £460,000. The work is divided into 14 contracts, two of which have been completed, while in the remainder work is in progress. In October, 1903, the work upon Main Sewer No. 1, which had been interrupted in 1900, was resumed under a new contract, and it is now nearly completed, the portions previously constructed having been examined and cleansed. This sewer passes through Kidderpore and Alipore, and only two short lengths adjoining Tolly's Nullah remain to be done. Great difficulty has been experienced by the contractors in the construction of a syphon under the Nullah, and these have not yet been overcome. Four miles out of the 22½ miles of sewers included in Mains Nos. 1, 2, 4 and 5 have been completed, and the progress made is satisfactory. The storm-water outfall works have been completed with the exception of a portion of the reservoir and the Makalpotta Sluice. The new town high-level sewer to have a 30-foot roadway over it; the new storm-water outfall for the suburban system of sewers, and a combined sewage channel for both the city and suburban sewers have been completed with the necessary sluices, bridges, syphons, &c. The suburban high-level sewer has been completed during the year, and the reflux gates in the suburban head-cut, the extension of the combined sewage channel, and new pumping stations at Ballygunge and at Budge-Budge Road are under construction. The scheme for the surface drainage of the suburbs is under preparation.

The design for the Balliaghatta drainage is complete and the sanction of Government has been obtained; the work will probably be taken in hand during the current year.

Water-supply.—The total quantity of filtered water supplied to the town, added area and suburbs during the past year amounted to 7,624 million gallons as compared with 7,542 million gallons during the previous year. If the population supplied with filtered water in Calcutta and the suburbs is estimated at 960,000 the supply per head of population would amount to 21·5 gallons. A mile was added to the filtered water mains, and the mileage now stands at 185 in the town and 133 in the added area, making a total of 318 miles.

The conversion of the intermittent to a constant supply has been hampered by the insufficient quantity of water which reaches Calcutta, but the population supplied under the constant system now totals 210,898, and was nearly doubled during the year. The average rate of consumption per head in the area under constant supply fell from 31·4 to 24·1, and much of this reduction was due to the work done in repairing leaky mains and connections, to surcharges for excess consumption, and to prosecutions for waste. An additional Assistant Engineer, Mr. H. J. Trivess Smith, was brought out from England in October last to push on with the work of conversion. The further extension is, however, at present in abeyance pending an increase in the water-supply, the urgent need of which has long been felt. Since the close of the year, the Corporation have sanctioned a scheme for augmenting the supply by putting pressure on the mains at Pulta.

A new proposal has been put forward by the Chief Engineer for the substitution of an elevated reservoir at Tallah for the existing system of pumping stations, his object being to supply the town and suburbs with water by gravitation instead of by pumping. This scheme is under consideration by a special committee.

The total quantity of unfiltered water supplied during the year amounted to 6,529 million gallons, which means an average of 24·1 gallons per head per day for

the 740,000 people supplied. The unfiltered water supply has been extended into 359 sewered roads, 40 miles having been added to the system of pipes, the total length of which now exceeds 212 miles.

The expenditure on water works amounted to £111,750 and the receipts to £107,100. The total fees realised by the sale of water to the shipping amounted during the year to £4,468, which is slightly below the receipts for the previous year.

Bustee Improvement.—This department is in charge of the Deputy Chairman. Improvements have been effected in two bustees under Sections 400 to 405, and in four other cases the owners voluntarily came forward with plans for new bustees. Much useful work has been done under Sections 406 and 407, though delay has resulted from the necessity of recommencing proceedings *ab initio* in several cases in which the original plans had not been approved within six months. The General Committee called for fresh reports in the case of 24 bustees and for new reports in the case of 18 others, and the services of the Plague Officers were utilised in preparing schemes.

Standard plans have now been approved for 24 bustees (7 in District No. I., 4 in District No. II., 9 in District No. III., and 4 in District No. IV.) and the subsequent action taken has resulted in the clearing away of the bustee at 6-3, Hiralal Mitter's Lane (District No. I.), and the whole of the bustee area (in District No. III.) of 25, Park Street and 1 and 2, Rawdon Street. At 133-134, Corporation Street masonry buildings are in course of erection on part of the old bustee, and the remainder is being improved in accordance with the directions of the Committee. The owners of 65-68, Machua Bazar Street, 47, Sham Bazar Street, 54-55, Sukea's Street (District No. I.) and of 17, Kassinath Mullick's Lane (District No. II.) have undertaken to carry out improvements, and the Corporation will be asked to contribute by making roads. Much work of a preliminary nature has also been done which will bear fruit later. Other improvements include the clearance of part of 23, Chatawalla Gully under the Plague Regulation, the acquisition and clearance by the Corporation of the most insanitary part of Jorabagan Bustee (in Ward V.), a noted plague centre, for the purposes of a public square, the improvement of Goomghur Bustee, through which the Corporation have constructed a wide thoroughfare, and the acquisition of the bustee at 26-27, Free School Street, purchased with a view to improving the eastern approaches of the Sir Stuart Hogg Market. The bustees at 28-30, Banstalla Gully, at 97 and 104-107, Ahiritolla Street, at 58, Upper Chitpur Road, and a portion of Tantibagan Bustee have also been rebuilt. The population dislodged from these demolished bustees is moving eastwards and southwards, and special action is being taken to lay out areas in advance for their occupation. An area of over 2,200 biggahs of land has already been laid out, spaces having been provided for roads of sufficient width at regular intervals. A scheme is under consideration for the construction of model dwellings on land belonging to the Corporation at Haritola.

Plague.—The plague mortality shows a substantial decline as compared with the statistics of recent years; the seasonal development has been somewhat later than usual. As in former years, the north of the town (comprising Wards 1-12) has been by far the worst affected. A special feature of the year's preventive work has been the demolition of large numbers of the most infected huts in bustees which have been ravaged year after year by the disease. It is too early yet to express a final opinion upon the success of this measure, but the consistent decrease in the mortality affords ground for hopeful anticipations. No steps have yet been taken to provide accommodation for the dislodged population, whose numbers are further swollen by the wholesale private purchase of bustees in the south of the town, which are being replaced by masonry structures. Disinfection has been carried out on a large scale, and arrangements were made to inoculate all willing to be inoculated. A list of precautions against the spread of plague was drawn up in simple language and printed in the vernacular, and freely distributed in all parts of the town.

The Plague Department continues to be administered by the Chairman under the authority vested in him by the Plague Regulation, expenditure being met from the revenue funds of the Corporation, with the exception of a small sum which represents the balance of the Plague Loans.

Health Department.—The death-rate was 35·1 per 1,000 as against 37 in the preceding year; the rate, excluding plague deaths, being 25·4 per 1,000. Cholera accounted for close on 2,000 deaths, but this was below the average, in spite of the fact that the mortality from this disease for this year was above the average in the province, and was specially severe in the district of the 24-Parganas. Several cases in the south of the town were traced to the use of the filthy water of Tolly's Nullah by pilgrims. Insanitary wells and tanks are still numerous, and it is a satisfactory feature of the year's work that 47 wells and 56 tanks were filled up. The mortality from malarial fever has diminished, but tuberculosis has increased in the last few years. The Health Officer's proposal to establish a sanatorium for the treatment of advanced cases of the latter disease was disapproved by a Sub-Committee on the ground that the social life and customs of the people would render the scheme ineffective.

The birth-rate registered rose from 14·2 to 15·5 per 1,000, but even the latter figure is far below the actual facts. The experiment of appointing a staff of peripatetic sub-registrars to collect information of births proved very successful, the number of births registered in the area under experiment being 51 per cent. above the average of the past three years, and it is proposed to extend the system to the other three districts.

Vaccination returns showed a further decline, and the department was again remodelled towards the end of the year by the appointment of seven inspectors and 24 vaccinators, the former on Rs. 60 to 75, and the latter on Rs. 20 to 30. The change yielded improved results during the last quarter of the year. Vaccine was obtained from Madras, pending the completion of the new vaccine depôt at Ballygunge. The outturn of work of the sanitary inspectors has been somewhat less than last year; their prosecutions resulted in the imposition of fines amounting to £2,058. The food inspectors did useful work and destroyed large quantities of unwholesome food, special attention being devoted to the milk, fish, mustard oil and ghee supply.

Much useful work has been done at the Municipal Laboratory. The filtered water-supply has been subjected to weekly analysis, and it maintained its character as a wholesome water, the only unsatisfactory feature being the continued presence of bacteria of the *colon* group. A large number of samples of food-stuffs were analysed. The gas was also regularly tested with satisfactory results, and bacteriological work was done both for the Plague Department and for private medical practitioners.

Cemeteries, Burial-grounds, &c.—Six insanitary burial-grounds were closed during the year, including the old Durgapore burial-ground, which had been the subject of much litigation in the Alipore Courts. The land recently acquired for Mahomedan burial grounds at Gobra and Bagmari has been taken over and prepared at a considerable cost. The land acquired in the previous year for an extension of the Lower Circular Road Christian Cemetery was, during the year under review, properly prepared and enclosed and handed over to the Christian Burial Board. An expenditure of £2,114 was sanctioned for raising the level of part of the area which has been taken up for a new Christian cemetery at Jadabpore; the work is in progress. Tenders for the construction of a crematorium of the latest improved design have been invited.

Conservancy.—The supervision of conservancy forms part of the duties of the District Engineers under the Reorganisation Scheme of two years ago, but the advisability of creating a separate department to take charge of this important work has been for some time under consideration. Upon the recommendation of a Special Committee, the Corporation decided in favour of the creation of a separate department (to be styled the Cleansing Department), under a responsible head, who should work directly under the orders of the chairman; but the Corporation postponed the consideration of the details of the scheme, and have not yet sanctioned the creation of the post of head of the new department. They have negatived two proposals on the subject, and the execution of the scheme is therefore still in abeyance. In the European wards the conservancy arrangements are, on the whole, satisfactory, and there has been some improvement, but in the north of the town the need for an afternoon service is keenly felt, and in the suburbs the establishments are undermanned. In December last the Commissioners sanctioned a special expenditure of

£1,400 for the maintenance of additional establishments in the northern wards of the town, for special conservancy and cleansing of bustees, as a precautionary measure against plague.

The experimental incinerator which Messrs. Joseph Baker and Sons, of London, have contracted to set up, under a guarantee against nuisance, at Entally, was completed before the close of the year, but the preliminary tests made rendered certain minor structural alterations necessary, and the incinerator has not yet been made over to the Corporation to work. When this is done, the contractors will be required to work the plant for eight months, including the rainy months, and an official trial will then be conducted.

ABSTRACT OF THE REPORT OF THE HEALTH OFFICER OF CALCUTTA FOR 1903.

(*Dr. J. Nield Cook.*)

Births.—The birth-rate of the town calculated on the registered birth was 15·5 per 1,000 of the population. As I have estimated in my last annual report that the true birth-rate of Calcutta should be not less than 26 per 1,000, basing my calculation on the number of women of child-bearing age living in Calcutta and the general fertility of women in this country, it is evident that the registration of births is still very defective.

I mentioned in my last report that the Commissioners had sanctioned a trial of a new system of registration of births in one district for one year as an experiment. Dr. Sen has carried it out in District I. One Registrar was employed to register births at the District Office and eight Sub-Registrars to conduct inquiries in the wards and obtain information of any births that occurred. A warning notice was issued to the parents of each infant, and if they failed to register the birth after that they were prosecuted. The results are encouraging, for in the nine months from April to December, the number of births registered in this district was 51 per cent. more than the average of the corresponding periods of the three preceding years in this district. I consider that this result is creditable to Dr. Sen, who carried out the experiment, and points to the desirability of adopting the system in the remaining districts. The number of still-births for the year was 6·6 of the total births, including the still-born.

Deaths.—The death-rate of the town was 35·1. A recrudescence of plague, which was somewhat severe, was the cause of this high figure. If the deaths reported under this head be subtracted from the total, the death-rate is reduced to 25·4, which is quite a moderate rate for Calcutta. Plague was administered by a special department, independent of the Health Department. It accounted for rather more deaths than the previous year. There was a good deal of cholera in the town in the first half of the year, though the total mortality from this cause was somewhat below the average. This may be considered fairly satisfactory, as the cholera mortality was above the average in the province and specially severe in the 24-Pergannahs which adjoins Calcutta on three sides. Still, taking into consideration the fact that Calcutta has a filtered supply of drinking water which has never been found to contain the germs of this disease, though it has been specially examined for them every week, there ought not to be nearly 2,000 deaths from cholera in a year. There is very little that can be done to check it, as it is in a large measure due to importation by pilgrims from outside, and in the town, as Dr. Mullan, the District Health Officer, has recently collected a number of cases to show, from the use of the water of Tolly's nullah in connection with the pujahs of Kalighat Temple. The water of the nullah is very impure and has often been found to contain cholera germs. The obvious measures are the improvement of the nullah by diverting drainage when the suburban sewerage is completed and patrolling the banks in the early morning to prevent the commission of nuisance. The devotees who bathe in the water and drink it will continue to do so until the gradual spread of education convinces them that they can serve their gods equally well without risking their lives by drinking diluted sewage. The polluted tanks and wells in the towns are also an important cause of the disease and a number are filled up every year under notices and prosecutions by the Health Department. The mortality from small-pox was low, as there is a more or less marked cycle in Calcutta extending over about five years, and we are at present in the period of

comparative quiescence. The mortality from fever was comparatively low, though it was somewhat above the average in the province and in the division of the 24-Pergannahs.

The comparatively low mortality registered as fever, 4,869 against 8,036 deaths, is to some extent to be attributed to more deaths being registered under "Other Causes," but, apart from this, I believe that there has been an appreciable diminution in malarial fever in Calcutta in the last few years. Fifty-one deaths were registered under enteric, which is probably below the actual number, as enteric in the native is apt to pass unrecognised and to be confused with other febrile complaints, and it is quite exceptional for medical practitioners in the town to notify their cases. In my last report I wrote at some length on the prevalence of phthisis in Calcutta. The mortality from this cause again shows an increase, amounting to 1,580, or 7·3 per cent. of the total mortality exclusive of plague, which I believe to be below the actual mortality from this cause. The question of adopting measures for dealing with this disease was considered by a Sub-Committee of the Commissioners, which was altogether opposed to my proposal to establish a home for advanced cases and made so much of the difficulties in the social life and customs of the people that I thought it advisable to await the growth of public opinion before commencing the campaign.

Vaccination.—The vaccination returns again show a falling-off on the whole, though there was a slight increase in Districts I. and III. Vaccination was performed during the greater part of the year by Hospital Assistants under the supervision of the District Health Officers, but without any Inspectors. I expressed my opinion in my last annual report that this system did not work well, and the question of the reorganisation of the Department was considered by the Commissioners, first by a Medical Sub-Committee and subsequently by the General Committee and Corporation, and the follwing recommendations were passed and confirmed:—

I. That the Health Officer and District Health Officers be called Superintendent and Deputy Superintendents of Vaccination, respectively.

II. That seven Vaccination Inspectors be appointed, two each for Districts I., II. and IV. and one for District III. on Rs. 60 rising to Rs. 75 in ten years by equal biennial increments.

III. That twenty-four Vaccinators, to be selected by the Health Officer, on Rs. 20 rising to Rs. 30 in ten years by equal biennial increments, be appointed.

IV. That the Female Vaccinators be employed in addition as at present.

This came into force on the 1st November, though some of the Hospital Assistant Vaccinators were kept on for the time being. It is too soon to report on the result of the change, but in the last quarter of 1903 the number of vaccinations was 4,264 against 3,668 in the corresponding quarter of 1902, which is encouraging.

I reported a year ago that a site had been purchased, plans passed and tenders accepted for the construction of a depôt for animal vaccination and the manufacture of preserved vaccine in Ballygunge. Owing to the land having to be raised and tedious delays having occurred in consequence, the new depôt has not yet been built. The preparation of vaccine was carried on under difficulties for the greater part of the year owing to insufficient accommodation for the calves and repeated outbreaks of rinderpest, which made it difficult to keep up a good stock, but eventually I obtained permission to discontinue the preparation of vaccine until the new depôt was completed and to purchase sufficient glycerised vaccine for my requirements from the Madras Municipality, which has been done with good results. The vaccination returns show that glycerised vaccine compared favourably with lanoline paste and calf lymph, and when the new depôt is opened I propose to give up lanoline altogether in favour of glycerine and to do most of the vaccination with glycerised vaccine if the people do not object and so avoid the inconvenience of carting about calves for vaccination.

Filtered Water-supply.—Fifty-two samples of Hugli River water as pumped into the settling tanks at Pulta, 52 samples of water from the settling tanks, and 104 samples of filtered water from the town supply were examined during the year. In the filtered water, the total solids, chlorine as dissolved chlorides, and total hardness ranged high from January to June, varying from 19 to 27 parts, 0·9 to

Statement of Deaths from different causes during 1903.

1. No. of Wards.	2. Names of Wards.	3. Population according to Census of 1901.	4. Cholera.	5. Small-pox.	6. Fevers.	7. Dysentery and Diarrhœa.	8. Plague.	9. Injury. Suicide. Male.	Suicide. Female.	Wounds and Accidents.	Snake-bite or by Wild Beasts.	Hanging-Execution.	Total.	10. All other Causes.	11. Total Deaths from all Causes.	12. Ratio of Deaths per 1,000 of Population. Cholera.	Small-pox.	Fever.	Dysentery and Diarrhœa.	Plague.	Injury.	All other Causes.	From all Causes. For the Year.	Mean of previous Five Years.
1	Shampooker	46,887	146	7	322	152	488	7	4	17	—	—	28	628	1,771	3·1	·14	6·8	3·2	10·4	·59	13·3	37·7	32·3
2	Coomartolly	30,155	90	3	209	121	320	1	1	19	—	—	21	491	1,255	2·9	·09	6·9	4·0	10·6	·69	16·2	41·6	39·7
3	Burtollah	50,216	128	5	345	139	574	6	9	15	—	—	30	734	1,955	2·5	·09	6·8	2·7	11·4	·59	14·6	38·9	33·6
4	Sukea's Street..	42,034	108	2	272	114	339	2	4	16	—	—	22	602	1,459	2·5	·04	6·4	2·7	8·0	·52	14·3	34·7	31·0
5	Jorabagan	49,069	160	4	203	144	1,228	2	4	32	—	—	38	583	2,360	3·2	·08	4·1	2·9	25·0	·76	11·8	48·0	44·9
	Mayo N. Hospital	—	6	—	9	13	3	3	2	5	—	—	10	26	67	—	—	—	—	—	—	—	—	—
6	Jorasanko	52,988	136	5	244	128	692	5	—	22	—	—	27	731	1,963	2·5	·09	4·6	2·4	13·0	·5	13·7	37·0	36·7
7	Burra Bazar	31,574	89	2	127	49	487	—	2	20	—	—	22	260	1,036	2·8	·06	4·0	1·5	15·4	·69	8·2	33·8	34·4
8	Colootollah	63,170	141	6	317	147	898	3	4	14	—	—	21	832	2,362	2·2	·09	5·0	2·3	14·2	·33	13·1	37·3	34·1
	Medical College Hospital ..	—	5	—	10	14	27	3	—	18	—	—	21	120	206	—	—	—	—	—	—	—	—	—
9	Moocheepara	64,116	107	1	376	158	463	3	4	23	—	—	30	924	2,059	1·6	·01	5·9	2·4	7·2	·47	14·4	32·1	30·8
	Lady Dufferin's Hospital ..	—	—	—	1	2	—	—	—	—	—	—	—	6	9	—	—	—	—	—	—	—	—	—
	Police Hospital	—	1	—	8	3	—	—	—	—	—	—	—	9	21	—	—	—	—	—	—	—	—	—
10	Bow Bazar	27,052	38	1	115	68	241	1	—	13	—	—	14	330	807	1·4	·03	4·2	2·5	8·9	·51	12·1	29·8	31·9
11	Puddopooker	28,060	68	—	145	62	190	3	2	7	—	—	12	404	881	2·4	—	5·1	2·2	6·7	·42	14·3	31·3	28·4
12	Waterloo Street	6,395	14	—	15	8	22	1	1	10	—	—	12	42	113	2·1	—	2·3	1·2	3·4	1·8	6·5	17·6	17·9
13	Fenwick Bazar	31,242	32	1	103	44	317	1	—	5	—	—	6	303	806	1·0	·03	3·2	1·4	10·1	·19	9·6	25·8	31·3
14	Taltollah	32,237	23	1	231	108	312	3	2	10	—	—	15	505	1,195	·71	·03	7·1	3·3	9·6	·46	15·6	37·0	35·3
15	Collinga..	16,780	16	1	91	49	148	1	2	7	—	—	10	226	541	·95	·05	5·4	2·9	8·8	·59	13·4	32·2	30·0
16	Park Street	6,127	7	—	11	7	21	1	—	1	—	—	2	21	69	1·1	—	1·7	1·1	3·4	·32	3·4	11·2	15·6
17	Bamun Bustee	5,503	—	—	8	5	1	—	—	1	—	—	1	47	62	—	—	1·4	·9	·18	·18	8·5	11·2	20·1
18	Hastings	4,444	5	—	36	9	70	—	—	1	—	—	1	84	205	1·1	—	8·0	2·0	15·7	·22	18·9	46·1	47·2
	Military Hospital	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total	588,049	1,320	39	3,198	1,544	6,841	46	41	256	—	—	343	7,917	21,202	2·2	·06	5·4	2·6	11·6	·58	13·4	36·0	34·0
	Fort William	4,612	8	—	23	3	—	1	—	3	1	—	5	30	69	1·7	—	4·9	·65	—	1·	6·5	14·9	14·5
	Port of Calcutta	29,768	50	—	26	4	—	1	—	36	—	—	37	12	129	1·6	—	·87	·13	—	1·2	·4	4·3	5·7
	Grand Total ..	622,429	1,378	39	3,247	1,551	6,841	48	41	295	1	—	385	7,959	21,400	2·2	·06	5·2	2·4	10·9	·61	12·7	34·3	32·7
19	Entally	38,626	96	—	361	170	370	—	—	15	1	—	16	677	1,690	2·4	—	9·3	1·4	9·5	·41	17·5	43·7	40·7
	Campbell Hospital	—	27	1	122	336	21	—	—	4	—	—	4	407	918	—	—	—	—	—	—	—	—	—
20	Baniapooker	28,202	23	1	205	91	211	—	—	9	—	—	9	353	893	·81	·03	7·2	3·2	7·4	·31	12·5	31·6	35·4
	Albert Victor's Leper Asylum.	—	—	—	—	2	—	—	—	—	—	—	—	34	36	—	—	—	—	—	—	—	—	—
21	Ballygunge and Tallygunge	27,207	68	—	178	92	120	1	—	5	—	—	6	386	850	2·4	—	6·5	3·3	4·4	·22	14·1	31·2	33·6
22	Bhowanipur	49,641	179	5	367	211	257	4	1	10	—	—	15	742	1,776	3·6	·1	7·3	4·2	5·1	·3	14·9	35·7	31·4
	General Hospital	—	4	—	4	3	—	—	—	—	—	—	—	18	29	—	—	—	—	—	—	—	—	—
	Shumbu Nath Hospital ..	—	2	—	4	7	—	—	—	3	—	—	3	24	40	—	—	—	—	—	—	—	—	—
	European Lunatic Asylum	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	—	—	—	—	—	—	—	—
	Alipur Lock Hospital ..	—	—	—	—	—	—	—	—	—	—	—	—	5	5	—	—	—	—	—	—	—	—	—
	Do. Jail Hospital ..	—	—	—	3	1	—	—	—	1	—	—	1	22	27	—	—	—	—	—	—	—	—	—
	Do. Police Hospital ..	—	—	—	2	—	—	—	—	—	—	—	—	5	7	—	—	—	—	—	—	—	—	—
	Do. Police Case Hospital	—	—	—	—	—	—	2	—	9	—	—	11	6	17	—	—	—	—	—	—	—	—	—
23	Alipur	17,718	77	—	81	50	32	—	1	5	—	—	6	147	397	4·3	·22	4·5	2·8	1·8	·33	8·2	22·4	24·1
24	Khidderpur and Ekbalpur	21,608	31	—	165	53	81	—	—	13	—	—	13	349	692	1·4	—	7·6	2·4	3·7	·6	16·1	32·0	34·9
25	Watgunge and Garden Reach	37,918	100	—	127	109	269	—	1	14	—	—	15	336	976	2·6	—	3·3	2·8	7·6	·39	8·8	25·7	24·7
	Total	220,920	607	11	1,619	1,125	1,381	7	3	88	1	—	99	3,514	8,356	2·7	·04	7·3	5·0	6·2	·44	15·9	37·8	38·9
	Canal	4,447	5	—	3	1	—	—	—	—	—	—	—	—	9	1·1	—	·67	·22	—	—	—	2·0	2·9
	Grand Total ..	225,367	612	11	1,622	1,126	1,381	7	3	88	1	—	99	3,514	8,365	2·7	·04	7·1	4·9	6·1	·43	15·5	37·1	38·1
	Combined Total ..	847,796	1,990	50	4,869	2,677	8,222	55	44	383	2	—	484	11,473	29,765	2·3	·05	5·7	3·1	9·6	·57	13·5	35·1	34·1

2·7 parts and 7·5 to 14 parts per 100,000, respectfully; while from July to December all these constituents diminished, ranging from 8·5 to 18·5 parts, 0·4 to 1·2 parts, 4·75 to 8 parts per 100,000, respectively. The albuminoid ammonia as determined by Wanklyn's process, the nitrates and the oxygen consumed varied from 0·0032 to 0·0056 part, 0·016 to 0·026 part, and from 0·004 to 0·012 part, respectively, during the year.

The water was free throughout the year from "free ammonia" and "nitrates." A slight opalescence in the filtered water was noticed during the rains, which is a recurring feature every year. Thus chemically considered, the filtered water supply of Calcutta maintained its character as a wholesome water.

Special bacteriological examinations of the filtered water were made every week throughout the year and in all the examinations the samples were found free from B. Typho-Abdominalis, B. Enteritidis sporogenes and Comma Bacilli.

The only unsatisfactory feature is the continued presence of bacteria of the Colon group, which were found in every examination of the filtered water in relatively large numbers. Bacterial counts of the filtered water as supplied to the town as well as those of the water from the collecting wells of the 36 filter beds at Pulta were generally below 100 per 1 c.c. The enumerations show no constant and definite relation between the head of water, number of days the filters have been in use and the number of bacteria found in the water.

Other Laboratory work.—Two hundred and forty-five samples of water from the River Hugli, settling tanks, filtered water of the town and from local tanks were examined. In 7 samples of tank water comma bacilli were found. It may be noted that in every instance cases of cholera occurred in the vicinity of such tanks. Eleven specimens of blood were tested for enteric fever by Widal's reaction and in five a positive result was obtained. Out of four specimens of sputum examined one showed tubercle bacilli. Two specimens of exudation from the throat were examined and in one diphtheria bacilli were found. Thirty dead rats and one guinea-pig were sent near the end of the year by the District Medical Officers of the Plague Department in connection with the occurrence of suspected plague cases in different parts of the town and examined, but plague bacilli were not found in any of them. It may be mentioned, however, that rat plague recommenced early in 1904. Samples of filth from the North Gowkhana were examined bacteriologically, and bacilli of malignant œdema, tetanus and cholera were found.

Out of 184 samples of ghee, 148 of milk, 8 of butter, 30 of barley powder, 6 of flour, 8 of arrowroot, 64 samples mustard-oil and 7 of a miscellaneous character analysed, 53 of ghee, 107 of milk, 1 of butter, 24 of barley powder and 42 of mustard-oil were found to be adulterated. The Analyst attended Court on 34 occasions to give evidence in adulteration cases.

Work done by the Sanitary Inspectors.—There were 4,602 notices served for the abatement of nuisance and 3,310 prosecutions with an aggregate fine of £1,255. There were 1,772 prosecutions in licence cases with an aggregate fine of £800. The number of cases of disease investigated was 8,617. The number of houses disinfected was 1,985 and steps were taken to remedy the sanitary defects found in the premises. Bedding and articles of clothing were disinfected and useless articles were burnt.

During the year all cases of death other than plague were enquired into and reported on by the Sanitary Inspectors. This has rendered the causes of death in the returns somewhat more accurate.

Most of the prosecutions in licence cases were, as in the previous year, due not to the owners being unwilling to take out licences, but to their carrying on their trades in insanitary premises for which licences had been refused until such time as the places should have been put in a sanitary state.

Fifty-six tanks and 47 wells were filled up during the year.

ABSTRACT OF THE REPORT OF THE MADRAS MUNICIPALITY FOR 1903-04.

(*S. D. Pears, Esq., President.*)

New Drainage Works.—In the early part of the year, the preparation of the detailed estimates for the whole scheme was completed, and the total abstract thereof was revised. The total estimate, thus revised, for the scheme, amounting to £324,364, was sanctioned by the Commissioners on the 29th May, 1903. The laying down of the cast-iron main was in progress, and 388 lineal feet of piping were laid, raising the total length laid to 11,319 feet. In fact, the whole length except the bit near the Mylapore Pumping Station, about 400 feet long, is completed. The flooring of the engine and boiler-house on Ice House Road was completed after the fitting up of the machinery.

At Napier Park, the Worthington pumps and boilers were procured, fitted up and tested. The connections to the cast-iron main from the two pumping stations above specified—Ice House Road and Napier Park—were laid up to the proposed stand-pipes.

The laying of sewers in south Triplicane was resumed, and 28,859 feet of pipes were laid.

The draining of Kosapet, Mylapore, was also put in hand and completed.

In addition to the above several other drains were completed during the year.

Water Supply.—During the year under report 948 yards of new pipes were laid and 10 fountains, 1 valve, 18 stop-cocks, 16 hydrants and 22 meters were fixed. The total length of pipes taken up, cleaned, and relaid during the year was 15,123 feet; this brings the total length taken up, cleaned and relaid since the commencement of the operations in September, 1900, to 337,291 feet.

On the 1st of April, 1903, the level of the Red Hills Lake stood at 42·85, and on the 31st March, 1904, at 43·22. There was no pumping during the year; the lowest level, 41·22, was reached on 26th November, 1903. The quantity of water supplied to the city during 1903-04 was 608,999,175 cubic feet, against 594,668,979 cubic feet last year.

Private Services.—Five hundred and thirty-three new services were laid by licensed plumbers during the year and 2,073 existing services were extended.

The quantity of water used for non-domestic purposes during the year was 105,690,667 gallons.

Vaccination.—The total number of cases vaccinated during the official year 1903-04 was 30,062, against 32,309 in 1902-03, showing a decrease of 2,247 cases, due to the less number of convicts vaccinated in the Penitentiary (372 less), coolies vaccinated in the Emigration Depôts (1,761 less), and cases vaccinated in the Municipal Depôts (114 less), as compared with the preceding year.

Out of the total cases vaccinated, 24,726 vaccinations were performed in the Municipal Vaccine Depôts and 5,336 in the Natal and Mauritius Emigration Depôts, as well as in the Penitentiary. In the Penitentiary, vaccination was carried on by the Municipal Vaccinator during the first four months of the official year and by the Medical Subordinates of the Penitentiary during the next eight months. 17,814 of the total cases were males and 12,248 females. The results of the vaccinations performed show that 26,453 were successful, 2,023 unsuccessful and 1,586 unknown.

The percentage of success obtained both in primary and re-vaccination excluding the unknown cases from the total was 92·90 against 90·34 in 1902-3, showing an increase of 2·56 per cent.

The different kinds of lymph employed in vaccination during the year are given below with the percentage of success obtained in each:—

—	Primary Vaccination.	Percentage of Success.	Re-Vaccination.	Percentage of Success.	Grand Total.	Percentage of Success.
Calf-to-arm vaccination... ..	17,249	99·84	2,337	83·57	19,586	93·00
Glycerine lymph	5,099	99·35	1,699	74·42	6,798	93·68
Lanoline vaccine	274	100·00	3,404	56·34	3,678	59·95

The lanoline paste obtained from the Mysore Vaccine Institute and used in the Emigration Depôts by the vaccinator employed by the Emigration Authorities in vaccinating the emigrant coolies (who were in most cases re-vaccinated) gave a percentage of 59·95 of success against 67·19 in 1902-3, showing a decrease of 7·23 per cent. The glycerinated lymph gave as good results as calf-to-arm vaccination.

The number of children vaccinated under one year was 17,036, including 31 cases which were done in the Emigration Depôts, against 15,092 in 1902-3, showing an increase of 1,944 cases due to the higher birth-rate in the previous year. Of the total, five were secondary vaccinations. The percentage of success obtained in the infant vaccination was 99·77 against 98·91 in the previous year. Of the total number of children vaccinated 13,006 were born in Madras and 4,030 in mofussil.

During the official year small-pox was far less prevalent than in 1902-3. There were only four deaths from this disease: one in April, two in May, and one in June, 1903. The infected houses were promptly disinfected by the sanitary staff. Every effort was made to induce the relatives of the small-pox patients to remove the infected cases from houses in which accommodation was insufficient to the Isolation Hospitals, and the infected houses were visited by the vaccine staff to vaccinate the unprotected children found in the neighbourhood. Re-vaccination was also encouraged in the infected localities and those who were willing to undergo the operation were re-vaccinated.

VITAL STATISTICS.—*Births.*—The total number of births registered during the calendar year 1903 was 19,830, exclusive of still-births, showing an increase of 2,087 births over the previous year. The ratio of birth per 1,000 of population was 38·9 against 34·8 of the previous year, the average of the ratios for the preceding decade being 40·1. This is the second highest number of births ever recorded in the City, the first being in the year 1900, which returned an exceptionally high number, 20,672. The greater number of births during the year under report occurred as usual in the second half of the year. Of the 19,830, the male live-births numbered 10,129 and the females 9,701, with the proportion of 104·4 males to every 100 females.

Deaths.—During the calendar year 1903 the total number of deaths registered from all causes was 19,205 against 21,395 in the previous year, the decennial average being 19,329·2. The ratio of death for the year was 37·7 against 42·0 of the previous year, the average of the ratios for the past decade being 41·4. In 1902 the number of deaths was greater than the births by 3,652, but in 1903 the number of births was greater than the deaths by 625. The year under report was on the whole a comparatively healthy one. Of the 19,205 deaths 9,874 were males and 9,331 were females, showing a proportion of 105·8 males to 100 females.

Mortality according to Divisions and Wards.—The 1st Division returned the highest death-rate, the ratio being 42·2, and the 4th Division returned the lowest with a ratio of 33·2. Amongst the 20 wards of the city, the 1st Centre, and the 2nd South, returned the highest death ratios, equally, viz., 47·5, while the 5th Division, South Ward, returned the lowest, 30·7.

Once again the death-rate of the 1st Division, Centre Ward, shows the extremely insanitary condition of this part of the city. So far as the portion of this ward known as Rope godown parcherry is concerned, it remains in the same primitive condition sanitarily as it was when the parcherry was founded, with the addition

that it is now probably a good deal more crowded and that the site has become progressively more polluted. As regards the Tinnevelly Settlement, a number of improvements was accomplished during the year both by the municipality and by private individuals, but until the whole place has been satisfactorily laid out, drained and provided with a good and constant water supply, and until the numerous insanitary wells have been closed and a larger number of suitable latrines have been provided, not much improvement in its mortality rate need be hoped for. The material condition of the inhabitants of 1st Centre, is, however, improving, judging by the large number of new buildings springing up on the sites of old houses. It is particularly necessary that the plans of these buildings should be carefully scrutinised and when passed that the actual building should be in accordance with or not inferior to the plan as regards its hygienic details.

The 1st Division, Centre Ward, continues to be the great rice-preparing emporium for the city, and it seems extraordinary that the chief food supply of the citizens should pass through the most insanitary corner of the town on its way to the consumer. If there is one portion of the town which ought to be scrupulously clean in every way and provided with the very best supply of water, it is this. The time is, however, approaching when the subject of its improvement will be taken up in earnest, and with the assistance of the Sanitary Commissioner, who inspected the Tinnevelly Settlement during the year, a scheme will, it is hoped, shortly be prepared for its improvement.

The high mortality in the 2nd Division, South Ward, is intimately connected with overcrowding and the existence in this ward of the extremely insanitary cattle yard area of Yedapalium. This latter evil could be remedied by the provision of a Municipal cattle yard on a plot between Wall Tax Road and the Canal immediately opposite to Yedapalium Street.

In most of the cattle yards in 2nd Division, South Ward, the cattle and the owner's family and probably some tenants dwell together in a house, barely more than sufficient for a fairly large family, so that neither the cattle nor the human beings have a fair chance. With a fairly large Municipal cattle yard at a convenient place it would be possible to close all the cattle yards of Yedapalium, and the sooner this is done the better.

Mortality according to causes:—During the calendar year the deaths have perceptibly decreased under all the principal heads of diseases. Five deaths occurred from plague (imported) against 10 in the previous year; 28 deaths from cholera (sporadic) against 37; 7 deaths from small-pox against 69; 96 deaths from measles against 225; 2,286 deaths from dysentery against 2,789; and 380 deaths from diarrhœa against 572.

Cholera.—Even with an improved water supply and satisfactory drainage over the whole city, it is impossible to hope that epidemic cholera will ever disappear from Madras while the state of the surrounding district remains as it is. Cholera is probably never absent from some part of the Chingleput district, and in nearly all cases in Madras last year the infection could be traced to a village outside, more especially to Saidapet, where the disease occurred amongst the dhobies. The infection there was traced to the river, the water of which was used by many for domestic purposes for want of a convenient supply of good water. The provision of a good water supply to the villages of the Chingleput district is almost of as much importance to Madras so far as protection from cholera is concerned as the provision of a good water supply for the city itself. Properly constructed and protected wells with pumps ought to be provided in every village.

Fevers.—During the year under report the total number of deaths from fevers was 6,129 against 7,326 in the previous year, with a ratio of 12·0 against 14·3. The average of the decade was 7,172·5. The 1st Centre Ward, returned the highest number of deaths from this disease, and the 6th North, the lowest, the former returning 731 deaths and the latter 53.

Infantile Mortality.—The number of deaths among infants under one year of age was 5,618 against 5,393 in the previous year, and the ratio calculated on the total infantile population under one year of age was 411·6 against 395·1, but the death ratio per 1,000 infants born alive was 283·3 against 303·9 of the previous year.

Plague Measures.—During the official year the Superintendent of Passports continued to supervise the passport establishment in the city. The plague staff remained the same as last year, except that an assistant passport examiner was added to each of the 3rd and 5th Divisions to cope with the work caused by the increase in the number of passports, and that the assistant plague inspector, 7th Division, whose services were dispensed with for some time, was re-entertained. For the Park Fair, the Industrial and Arts Exhibition and the Indian National Congress a special staff of eight plague inspectors was entertained.

Perambore and Bitragunta continued to be Passport Issuing Stations during the year.

The number of persons detained during the year in the two plague camps in the city was: Perambur, 1,370; and Egmore Plague Hospital, 99.

Nine imported cases of plague occurred in the city during the year, of which eight proved fatal. All of them were removed and treated in the Egmore Plague Hospital.

The total number of passports issued at Perambur during the year was 114,542 against 68,471 in the previous year, an unusually large number. This is due to a large increase in the number of notified stations and to the Indian National Congress and Industrial and Arts Exhibition. 3,127 passports were left untraced during the year against 1,065 in the preceding year, giving a percentage of 2·73 against 1·65. The number of mofussil passports received was 12,144 against 11,017 of the previous year. Of these 398 could not be traced, giving a percentage of 3·27 against 4·64 of last year.

The attendance of the passport holders was satisfactory. During the year there were 246 prosecutions and 151 convictions against 164 and 112 respectively in the previous year. The fines imposed amounted to Rs. 857-8-0 against Rs. 386 in the preceding year.

It is satisfactory to note that a very considerable amount of assistance in connection with the detection of actual or suspected cases of plague was received from the public during the year.

The Port Health Officer reports as follows with regard to the inspection of vessels:—314 vessels, departures from Madras, carrying a crew of 30,078 persons and 34,264 passengers, were inspected during the official year and granted bills of health. The inspection of the crews and passengers was carried out on shore. Besides the above, 161 vessels, arrivals from plague-infected ports, and carrying a crew of 13,323 men and 6,657 passengers for Madras, were inspected on board before communication between the vessels and the shore was permitted. All passengers landing at this port were granted plague passports. On board these 161 vessels 10,700 shore coolies worked. Before being sent on board the names and addresses of the coolies were taken down, and on their return in the evening they were given a disinfecting bath of perchloride of mercury—such of the coolies as were absent on the following morning were inspected at their houses under the orders of the Municipal Health Officer.

ABSTRACT OF THE REPORT OF THE MUNICIPAL COMMISSIONER FOR THE CITY OF BOMBAY FOR 1903-04.

(*W. L. Harvey, Esq., C.I.E.*)

PUBLIC WORKS.—*Drainage.*—The machinery at the Colaba Air Compressor Station and the several Ejector Stations and at the Love Grove Air Compressor Station worked satisfactorily during the year, except that at the latter station an accident occurred on the 20th June, 1903, which involved serious damage to No. 3 compressor engine.

The engines and pumps at the Love Grove Pumping Station also worked satisfactorily, except on one occasion when there was a total stoppage of a short duration caused by the fracture of a pump gland of No. 4 engine on the 11th December, 1903, at a time when No. 4 engine was the only engine at work.

The street portions of house drainage connections carried out numbered 711, at at cost of £1,848.

Latrines and urinals at different places have been constructed to meet the public convenience.

Works in connection with the sanitary arrangements of the various Health Camps, Observation Camps and Plague Hospitals were carried out by the Drainage Department, Ordinary Branch.

Several works executed by the Drainage Department, Special and Ordinary Branches, have been detailed in the Executive Engineer's report.

WATER WORKS.—*Tansa Lake.*—The rainfall for 1903 was 103·12 inches against 89·87 inches for 1902. The total quantity of water received in the lake was 49,087 millions of gallons, or 62·4 per cent. of the rainfall on the catchment area of 52·5 square miles.

Vehar Lake.—The rainfall for 1903 was 102·30 inches against 72·92 inches for 1902. The total quantity of rain which fell on the whole of the drainage area of 3,900 acres was about 9,051 millions of gallons, of which about 8,510 millions of gallons, or about 94 per cent. of the total rainfall, reached the lake.

Tulsi Lake.—The rainfall for 1903 was 129·16 inches against 93·19 inches for 1902. The total quantity of rainfall on the whole drainage area of 1,700 acres was 4,981 millions of gallons, of which about 4,454 millions of gallons reached the lake—this is about 89 per cent. of the total rainfall. During the year there was no burst in the mains of the Salsette Division.

Supply and Distribution.—In the body of the Executive Engineer's report will be found the descriptions of the several mains either laid or sanctioned. There were 70 bursts in different mains, 329 new connections were made, and 179 connections were cut off for various reasons. The total number of connections at the end of the year was 20,833, and the number of meters in use was 3,208.

Public Health.—The state of the public health during the year was somewhat worse than in the previous year. Exclusive of still-born the number of deaths was 50,513, being 2,099 more than in the previous year. There were 20,788 deaths from plague and 1,477 deaths from small-pox against 13,820 and 288 respectively in 1902. The Executive Health Officer describes in his report the measures adopted by him in combating the epidemics of plague and small-pox. The number of births registered during the year was 16,375, being 1,224 less than in the previous year.

ABSTRACT OF THE REPORT OF THE HEALTH OFFICER OF BOMBAY CITY FOR 1903.

(*Dr. J. A. Turner.*)

Births.—The number of births registered during the year was 16,375, being 1,224 less than in the last year and 3,332 more than the average of the preceding five years, giving a birth-rate of 21·10 per 1,000 of the population as against 22·67 during the corresponding period of the last year; of the total number of births 8,506 were males and 7,869 females, and 1,818 still-born births. The decrease in the number of births is due to the fact that a large number of people had left Bombay during the first five months of the year owing to the scare of plague, the mortality from which was very high during those months; rate amongst Parsees was 25·26 and amongst Europeans 14·34 as against 24·55 and 11·81, respectively, during the last year.

Mortality.—The number of deaths in the City of Bombay during the year 1903, exclusive of still-born, was 50,513, being 2,099 more than in the previous year, but 8,618 less than the average of the preceding five years, giving an annual death-rate of 65·09 per 1,000 of the population.

The mortality during the year under report, although more than in the previous year, was the lowest of the previous corresponding period of any year since 1898, as shown below, and was chiefly due to plague and small-pox:—

Year.	Total Number of Deaths.	Year.	Total Number of Deaths.
1898...	51,961	1901...	59,495
1899...	56,434	1902...	48,414
1900...	79,350	1903...	50,513

Plague Mortality.—As in the previous year, the control of all the plague measures was under the Health Department in the year under report. The mortality from plague commenced to rise, as usual, in the month of January, and reached its maximum on the 31st of March, and then declined. The number of attacks and deaths registered from plague during the year was 23,344 and 20,788 respectively, as against 16,423 attacks and 13,820 deaths during the previous year. The general Hindu community suffered severely from plague as in previous years, the number of deaths amongst this class being 13,288 as against 8,597 during the last year.

There was an increase in the number of deaths from plague in all the communities except Europeans and Negro-Africans, who show 8 and 4 deaths as against 13 and 9, respectively, during the previous year. There was a decrease in the number of deaths from plague in Girgaum, 1st Nagpada and Sewri Sections, the number being 471, 27 and 144, respectively, as against 576, 45 and 145 during the last year. In all the other sections of the city, there was an increase in the number of deaths from plague.

As regards the larger number of deaths in Worli Section, 1,884 as against 761 during the past year, I may point out that Worli is a large manufacturing district, as evidenced by the fact that it contains 35 large mills and one very large workshop belonging to the B. B. & C. I. Railway Company, where thousands of workpeople

are employed daily. The labourers naturally like to live as close to their places of work as possible, and hence the district is apt to be congested. It is a well-known fact that overcrowding is an important factor in increasing the number of deaths from plague.

Our difficulties in combating the plague during the earlier part of the year were aggravated by the presence of a woman at Worli who posed as a goddess gifted with the power of curing plague. Large numbers of people gathered round her residence and many plague patients were conveyed in public conveyances to her. As soon as this was brought to my notice, every endeavour was made to prosecute the woman, and the police, under Sections 268 and 269 of the Indian Penal Code, instituted the necessary proceedings. The Magistrate, in the first instance, acquitted the woman, and we were rendered helpless owing to the limited powers granted to the Health Officer, but subsequently an appeal having been made to higher authorities, further proceedings were instituted and the woman was convicted.

Out of 20,788 deaths from plague 13,288 were amongst males and 7,500 amongst females, as against 9,159 and 4,661, respectively, during the last year.

The highest plague mortality was recorded in the month of March, the number being 5,865, April coming next with 5,737; the lowest mortality was in November, 221 deaths being recorded.

In the following table it will be observed that there has been a marked decrease in the number of deaths from fevers, cholera, phthisis, diseases of the nervous system, diarrhœa and dysentery as compared with the figures of the last year:—

TABLE SHOWING THE NUMBER OF DEATHS AND THE DEATH-RATE FROM DIFFERENT CAUSES IN 1902 AND 1903.

Cause of Death.	1902.		1903.	
	Number of Deaths.	Death-rate per 1,000 of Population according to the Census of 1901.	Number of Deaths.	Death-rate per 1,000 of Population according to the Census of 1901.
Small-pox	288	·37	1,477	1·90
Measles	642	·82	1,115	1·43
Fevers	4,518	5·82	2,333	3·00
Cholera	75	·09	17	·02
Plague	13,820	17·80	20,778	26·78
Phthisis	3,957	5·09	2,842	3·66
Diseases of the Nervous System	3,027	3·90	2,282	2·94
„ Respiratory System	7,250	9·34	7,101	9·15
Diarrhœa	2,266	2·92	1,757	2·26
Dysentery	1,377	1·77	1,003	1·29
Accidents	732	·94	547	·70
All other Causes except Still-born	10,462	13·48	9,251	11·92
Total	48,414	62·38	50,513	65·09

By sexes, 28,934 males and 21,579 females died during the year. The highest number of deaths amongst males occurred in the age-period between 20 to 25 years, 3,484 deaths having been registered, and amongst females, like the previous year in the age-period of 15 to 20, 2,218 deaths having been registered. The lowest number of deaths amongst males and females occurred in the age-period between 4 to 5 years, 292 and 283 deaths respectively having been registered during the year.

Death-rate by classes.—The Jain community, which includes Banias, recorded the highest mortality, viz., 143·87 per 1,000 of population. Next came Lingaets, the death-rate amongst this class being 90·01. The general mass of the Hindu community give a death-rate of 68·66. Hindus, low-caste, show the death-rate of 68·23, and Musselman 66·05. The death-rate amongst Parsees was 29·56. European death-rate being less than the last year, viz., 15·48 as against 21·99. Negro-Africans and Buddhists, who form very small communities in the City, showed the death-rate of 65·49 and 37·97, respectively.

Small-pox.—From small-pox 1,477 deaths occurred during the year, as compared with 288 in the last year and 792 during the average of the previous five years. The disease prevailed in an epidemic form in the earlier part of the year and then subsided. It was feared that small-pox would again break out in the City in an epidemic form, and on the 19th December I immediately issued a circular to all the Divisional Health Officers and the District Registrars drawing their attention to it and requesting them to make strict enquiry and investigation into each case of small-pox and to remove all such cases to hospitals, to strictly disinfect the clothes, and persuade all unvaccinated contacts to get vaccinated; 13 cases of small-pox occurred in a chawl at De Lisle Road and 7 cases in another chawl at Curry Road occupied by mill-hands. The chawls were disinfected and the clothes sterilized. The patients were removed to hospitals and their rooms thoroughly disinfected. After a fortnight 184 persons from these chawls were vaccinated at the Municipal Dispensary at De Lisle Road. The prompt measures taken by the Divisional Health Officers in isolating the sick and disinfecting the buildings have checked the spread of the disease.

Cholera.—17 deaths from cholera were registered during the year, being 58 less than in the last year and 935 less than in the corresponding period of the preceding five years. The cases were of sporadic nature. Of the total number of deaths 11 occurred amongst Hindoos of other caste as against 47 in the previous year; 2 amongst Mussulmans as against 13 in the previous year; 3 amongst Hindus of lower caste, and 1 amongst Parsees as against 4 and 5, respectively, in the previous year; 2 deaths occurred amongst persons who had resided in Bombay for 3 months and under, and 2 amongst those who resided in Bombay for 6 months and under. Out of 17 deaths, 13 occurred amongst persons born out of Bombay.

Fevers.—The total of 2,333 deaths was registered from fevers during the year, as compared with 4,518 in the last year. Malarial fever, including ague and remittent fever, claims the highest number, viz., 2,288, being 2,141 less than the last year and 3,580 less than the average of the preceding five years. To enteric fever 45 deaths were registered, being 44 less than the last year and 13 less than the average of the preceding five years. The diseases, as in previous years, commenced rising from January to March. In February the highest number of deaths, viz., 254, were registered, and from the month of April the disease gradually declined till the end of the year. Excluding Negro-Africans and Buddhists, who form very small communities, there was a decrease in the number of deaths in all the other communities as well as in all the sections of the City.

The general mass of Hindu community show a remarkable decrease, the rate being 2·80, as against 6·02 in the previous year. Mussulman give the death-rate of 2·85 as against 5·21 in the previous year. From the statement given below it will be seen that the deaths registered from fever mortality are much lower than any of the previous years from 1894. This is due to the accurate registration of the causes of deaths, as every death is carefully inquired into by the District Registrar, and in many instances certificates from the medical men certifying the causes of death are received, thus a more accurate diagnosis is obtained.

STATEMENT SHOWING THE NUMBER OF DEATHS FROM FEVERS FROM 1894 TO 1903.

—	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.
Number of deaths from fevers	6,458	6,404	8,776	6,951	4,114	5,063	7,928	7,921	4,518	2,333

Infant mortality.—The number of births registered during the year was 16,375, giving an infant mortality of 532·39 per 1,000 of the births. Small-pox and measles prevailed during the year in an epidemic form, and accounted for 436 and 441 deaths of infants under one year of age, respectively, as against 87 and 205 deaths in the previous year. Diseases of the respiratory system are stated as being responsible for 2,290 deaths amongst infants under one year of age as against 2,347 in the previous year. The other causes given are—Diseases of the nervous system, including "convulsions" 1,591, debility 2,570, of the latter 2,071 deaths were among infants under thirty days. Diarrhœa is responsible for 539 deaths amongst infants under one year of age.

APPENDIX.

No. 1.

MEMORANDUM by the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER with the GOVERNMENT of INDIA for 1903.

The Director-General, Indian Medical Service, in his capacity of Sanitary Commissioner with the Government of India, has hitherto prepared and signed the Annual Sanitary Report; but since the 6th of September, 1904, he has been relieved of the sanitary part of his duties, and the Report for 1903 appears under the signature of a separate officer, who retains the title of "Sanitary Commissioner with the Government of India." In the concluding paragraph of the Report the circumstances under which this change was effected are briefly described.

2. The meteorological features of 1903 do not appear to have differed widely from normal. As regards the rainfall, however, it is stated that it "was generally in excess in August, September, and October, and was irregularly distributed in the remaining months of the year." The harvests were, on the whole, abundant, and food prices slightly lower; but the health of the general population, as measured by the death-rate, was not so good as in the preceding year.

3. It might have been expected that the health of the European Army of India would have suffered, or at least would not have improved, whilst that of the surrounding population underwent deterioration. But, on the contrary, the returns show the sickness amongst both the European and Native troops to have been less than usual. In the European Army, the average strength of which had increased to 70,445 from 60,540 in 1902, the ratio of admissions into hospital was the lowest on record; and the ratios of constantly sick, of deaths, and of invalids were lower than those of the preceding year, as well as of the quinquennium 1897-1901. From plague, which was the main cause of the increased mortality amongst the general population, the European Army was comparatively exempt. Yet, small though the loss from this disease has, so far, been, the returns show that the risk of infection incurred by the troops varies, as in the case of most other epidemic diseases, in proportion to the intensity and extent of its prevalence amongst the general population. During the preceding year, when the deaths from plague amongst the native population numbered 583,937, two cases with one death were recorded among the European troops; whilst, during the year under report, when the deaths among the former rose to 865,578, twelve cases with two deaths were recorded among the latter.

4. As usual, malarial fevers and venereal disease were the chief causes of sickness; the former accounting for 23·9 and the latter for 23·5 per cent., of all the admissions into hospital. In the previous year the corresponding figures were 23·5 for malarial fevers and 26·0 for venereal disease; so that, whilst the percentage of admissions due to the former remained practically the same in both years, there was a marked decrease in the percentage due to venereal disease in the year under report. But, although the chief causes of sickness, these diseases were accountable for only an inconsiderable share of the total mortality. The deaths due to malarial fevers, or to ague and remittent fever together, numbered 41; whilst 10 were credited to venereal disease. The chief causes of death continued to be, as in the preceding year, enteric fever and hepatic abscess; the former accounting for 291 and the latter for 91 of a total of 896 deaths from all causes. Between them, these two diseases were credited with a percentage of 42·0 of all the deaths in the European Army of India, or almost the same as in the previous year. The mortality from nearly all the other death causes, excepting cholera and small-pox, showed a substantial decrease; the total ratio of deaths, per thousand of average strength, from all causes falling to 13·05 from 14·68 in 1902. Accompanying the lower rates of sickness and mortality, there was a marked decrease in the proportion of men invalided. This fell from 37·25 per thousand of strength, in 1902 to 29·29 in the year under report. "There was a remarkable decrease in the number of men "sent home on account of secondary syphilis and debility." Judged by the returns, the health of the troops in all of the four Commands was better in the year under report than in the previous year, except in the Madras Command, where there was no change. The Sanitary Commissioner graphically sums up the comparative result for 1903 and the preceding year in these words:— "If the sickness, mortality and invaliding rates had been the same as those of the preceding "year, there would have been 3,162 more men admitted to hospital, 220 more constantly sick, "115 more deaths, and 561 more men invalided."

5. Among the chief diseases from which the Army suffered during the year, *influenza* finds a place; but although credited with an admission rate of 3·1 per thousand of strength, as compared with only 1·8 in the preceding year, no death was directly ascribed to it.

6. *Cholera*, from which the European Army had enjoyed remarkable immunity during the two preceding years, increased synchronously with the increase of the disease among the general population during the year under report. Whilst in 1901 there were only 12 cases, and in 1902 only 3, all of them fatal in both years, the number rose in the year under report to 81 attacks, with 57 deaths. Going back to 1900, a year in which cholera prevailed with unprecedented violence amongst the general population, the number of European soldiers attacked was 107, and of these 88 died. Although unremitting attention to every sanitary detail affecting the soldier

has succeeded in steadily reducing his liability to cholera, until the ratio of attacks has fallen from 5·4 per thousand of strength in the five-year period 1875-79 to only 0·8 in the period 1901-03, the close connection shown by the returns to exist between the rise and fall of the disease amongst the native population and its rise and fall in the armies of India would hardly encourage the hope that it can be completely eradicated from the Army so long as it continues to prevail, with but little abatement, amongst the people of the country.

7. If *small-pox* is the preventable disease which is is generally believed to be, and if its prevention can be secured by efficient vaccination and re-vaccination, the returns of sickness and mortality during recent years would seem to suggest the need for inquiry into the cause of its increasing prevalence in the European Army of India. Beginning with 1898, the returns show that two attacks, with no death, occurred in that year. In the following year there were 14 attacks, with one death; in 1900 the attacks increased to 36, and the deaths to 3; in 1901 the number of attacks fell to 20, whilst the number of deaths remained at 3; in 1902 the attacks again slightly increased to 23, and the deaths to 4; whilst now, in the year under report, the number of attacks have sprung up to 68, and the deaths to 8. During those years the mortality from small-pox among the general population has also increased, the number of deaths due to it ranging from a minimum of 53,347 in 1899 to a maximum of 115,603 in 1902. Doubtless there is an intimate connection between this increased prevalence of the disease amongst the native population and its increase amongst the troops stationed in its midst; but experience has proved that death from small-pox, instead of being not uncommon, is extremely rare in the case of persons who have been efficiently vaccinated and re-vaccinated. The protection of the native population by vaccination, which would indirectly conduce to the protection of the Army also, has been seriously interfered with by the epidemic of plague from which India has been suffering since 1896.

8. A slight decrease in the ratio of admissions and deaths from *ague* is recorded. The ratio of admissions, which had been 247 per thousand of strength in the previous year, has fallen to 243 in the year under report; the ratio of deaths falling at the same time from 0·5 to 0·34. To what extent these results may have been influenced by the measures adopted for the destruction of infection-bearing mosquitos is uncertain. The Sanitary Commissioner writes: "There can be "no doubt that the efforts put forth during the past year have been far more general, more com- "plete, more consistently and energetically maintained, and better organized than heretofore. "At the same time signs are not wanting that in many respects the work has yet to be developed "in its range and in completeness, before we can hope for measurable results." The measurement of results, it may be anticipated, will not always be easy. The sickness due to malarial fevers in stations will be liable to vary from year to year independently of the abundance, or even absence, in them of infected mosquitos. It is stated that, in at least 13 stations, a careful search failed to discover *anopheles* of any kind; yet the troops in those stations did not enjoy immunity from malarial fever. In such cases it may be assumed that the disease was imported by men who had been infected elsewhere. Varying climatic conditions, especially those connected with the amount and regularity, or irregularity, of the season's rainfall, may be expected to exercise an effect on the results which it will be difficult exactly to determine. The administration of quinine as a prophylactic is another factor which will have to be taken into the reckoning. So far, "the dose, the interval between doses, the method and period of administration have varied "in almost every instance, and very few medical officers have committed themselves to an opinion "of its value."

9. Of the chief diseases, *enteric fever* continued to be the most fatal. Although responsible for only 19·6 of a total ratio of 1,033·4 admissions, the ratio of deaths due to it was 4·19 of a total of 13·05; that is to say, it was the cause of close upon one-third of the entire mortality of the year in the European Army of India. The enteric fever admission-rate was considerably higher than in the previous year; but the death-rate was fractionally less. That the mortality caused by it during the year was no higher is matter for satisfaction, in view of the high proportion in the Army of men of the age and length of service in India when they are most susceptible to attack. Of the average strength, 51 per cent. were under 25 years of age and 25 per cent. had less than one year's service in India. Of the section of the Sanitary Report devoted to an account of the health of the European Army of India during the year, just one-half is taken up with a history of enteric fever; an allotment of space not disproportionate to the importance of the disease as a cause of sickness and mortality. The list of papers and books appended to the section will afford some idea of the labour which must have been involved in the preparation of the concise sketch given of the latest researches carried out with the object of throwing fresh light on the causation and prevention of this disease. Perusal of the sketch does not leave the impression on the reader that any very definite advance has been made during the past year in our knowledge of these questions. At the time this *memorandum* is being written, a severe epidemic of enteric fever, from which Lincoln, a town of about fifty thousand inhabitants, has been suffering, is undergoing investigation at the hands of scientific observers, and the results recorded from time to time in the medical journals. The most striking feature in the account given of the epidemic, in the course of which 815 persons have already been attacked, is its remarkable similarity to the accounts given of preceding epidemics of enteric fever. There is a sudden and widespread outbreak, suggestive of some common source of infection. The water-supply is suspected, and a bacteriological and chemical examination confirms the suspicion that the disease has its origin in, and is being disseminated by, water containing the *materies morbi*. Immediate steps are adopted for the purification of the water-supply, and, after two or three weeks, the number of people attacked begins to diminish. As a consequence of the measures taken for its purification, the water "now sent into consumption" is shown by analysis to be "innocuous"; but, unfortunately, cases of the disease still continue to recur, and in no inconsiderable number. This persistence of the epidemic after the water has been pronounced to be "innocuous" has to be accounted for; and "the 145 cases since 17th February" are said to have been "probably

"all secondary cases"; that is to say, "attributable to direct or indirect infection from the "primary cases." The specific germs of enteric fever must have been present in the water before the outbreak; yet, although it may be assumed that the water-supply of the town was periodically submitted to bacteriological and chemical examination, it was not until after an extensive outbreak of the disease that the discovery of its specific contamination was made. Even so slight a sketch may help to indicate how little the latest methods of procedure in dealing with an outbreak of enteric fever have been affected by fresh knowledge of the disease gathered from the voluminous records of recent scientific research.

10. Whilst the admission-rate from *tubercle of the lungs* remained the same as last year, the death-rate from this cause was the lowest on record; the 17 fatal cases yielding a ratio per thousand of strength of only 2·4. From *pneumonia* there were 40 deaths, and from *other respiratory diseases* 15, the ratio of mortality in the case of the former disease being much, and in the case of the latter diseases being slightly, below the ratios recorded in the previous year.

11. From *dysentery* there were 49 deaths, giving a ratio of ·70 per thousand of strength, as compared with ·69 in the previous year. No fatal case of *diarrhœa* was recorded. Next to enteric fever, *abscess of the liver* was the most fatal of all the diseases and the cause of 91 deaths, or equal to a ratio of 1·29 per thousand of strength, as compared with 1·85 in 1902. As in the previous year, Naini Tal and Barrackpore were the two stations which, in proportion to the strength of their garrisons, suffered most from this disease. Dysentery, between which and hepatic abscess an intimate connection frequently exists, was also exceptionally prevalent in both stations.

12. Last year's returns showed that the reductions annually recorded in the number of admissions from venereal disease since 1895 had at length received a check and been even replaced by a slight increase. Fortunately, this set-back has proved to be only temporary, and the reduction has recommenced in the year under report; the admission-rate falling to 247 per mille of strength. "One must go back to 1897 to find a lower rate than that of the year under "review." But, when in this year of much reduced admission-rate, the returns still show that 1,569·49 men were constantly sick on account of venereal disease, it will be realized how much of the inefficiency of the Army still continues to be due to this one cause. Of all the measures adopted with the object of abating this disease in the Army, none is likely to be more effectual than the education of the soldier. His misfortunes are largely due to his ignorance. As the Sanitary Commissioner says:—"We must look to the education of the men who suffer largely "through ignorance and lack of self-control, which are the results of the environment from "which they are mostly drawn; and the lectures which are now a feature of many regimental "institutes are a sign that this is becoming appreciated."

13. The health of the *Native Army*, of an average strength of 124,660, or almost the same as in the previous year, was exceptionally good, the returns showing a decrease in the ratios of admissions into hospital, of constantly sick, of deaths and invaliding. As in the case of the European Army, *intermittent fever* was also a chief cause of sickness in the Native Army. The admission rates from this disease were nearly the same in both armies; amounting to 242·6 per thousand of strength amongst the European, and 247·4 amongst the Native troops. But in respect of the other chief cause of sickness in the European Army, *venereal disease*, the ratios of admissions due to it in the two armies differed widely; the ratio in the European Army having been 247·0 per thousand of strength, and in the Native Army only 24·5. It was in no small part due to the comparative immunity of the Native troops from this disease that their admission rate for the year was only 622·0 per thousand of strength, against 1,033·4 for European troops. If venereal disease were excluded from the returns, the admission rate from all other causes would be 637·5 for the Native and 786·4 for the European Army. Still more striking is the contrast between the rates of admission from *enteric fever* in the two armies. Whilst a ratio of 19·6 admissions per thousand of strength is recorded from this disease in the European Army, a ratio of only ·6 is recorded from it in the Native Army.

14. Of the chief diseases, *influenza* and *cholera*, the former was the cause of a somewhat greater, and the latter of the same, rate of admissions into hospital in the Native as compared with the European Army. The most severe outbreak of cholera occurred at Mian Mir, where, of 34 men attacked, 29 died. Infection was attributed to the use for drinking purposes of canal water which is liable to pollution by native civilians. The death-rate from cholera amongst the native troops of the Bengal Command is traced, in the records of six consecutive periods of five years each, from 1870 to 1900, showing that it has fallen from 1·1 per thousand of strength in the first of those periods to 0·9 in the last, and still further, to 0·34 in the three years 1901-03. The fall has been by no means regular, nor very marked until the last three-year period 1901-03 is reached. Taking the six complete periods of five years each, the death-rate for the first was exceeded in two of those that followed, was less in other two, and the same in one.

15. From *small-pox* the Native suffered less than the European Army. Whilst in the former the admission rate was only ·6 per thousand of strength, with two deaths, it was 1·0 with eight deaths in the latter. These results are unusual and contrary to what might have been looked for.

16. Although the admission rate due to *intermittent fever* fell from 274·5 in the previous year to 247·4 in the year under report, it accounted for 37 per cent. of all the admissions. It was, however, responsible for only 82 deaths, or a ratio of ·66 per thousand of strength. *Remittent fever*, on the other hand, whilst the cause of the comparatively small admission rate of 8·6, accounted for 110 deaths, yielding a rate of ·88, or nearly 9 per cent. of the total mortality in the Native Army. Both types of fever were much less prevalent during the year under report than in the preceding decade.

17. According to the returns, *enteric fever* was somewhat more prevalent and fatal in the Native Army than in the preceding year. As the Sanitary Commissioner puts it: "The admission "rate on account of enteric fever has shown a tendency to a small but regular and definite "increase during the last few years." Whether this increase is the result of a growing prevalence of enteric fever amongst the native troops, or only of altered methods of diagnosis, is uncertain. The admission and death-rates of ·6 and ·22, respectively, ascribed to the disease, are still insignificant in comparison with those recorded in the European Army. The greater liability of the Gurkhas than of the other soldiers of the Native Army to suffer from enteric fever is, again, clearly brought out in the returns. In the Army Department Medical Report for 1902, page 210, the writer repeats a theory sometimes used to account for the comparative immunity of the natives of India from enteric fever. "Natives," he says, "are saturated in "enteric fever from childbirth and become immune. The germs are always in their surroundings, "and are thus attenuated for them and virulent for Europeans." Statements of this nature are not infrequently made, but without the evidence on which they are based. If the statistics furnished by the Secretary of State for War may be relied on, the enteric fever "germs" would appear to be no less abundant and virulent in some other parts of the world than in India. Replying, a year ago, to a question put to him in Parliament by Dr. Farquharson, he stated that, whilst during the war in South Africa 719 officers and 6,863 non-commissioned officers and men were killed or died of wounds, no fewer than 183 of the former and 7,807 of the latter died of enteric fever.

18. The extension of the *plague* epidemic has not been accompanied by a corresponding increase in the number of cases of the disease amongst the soldiers of the Native Army; but the mortality due to it was the highest yet recorded in any one year. During the preceding year the attacks numbered 192 and the deaths 95; whilst in the year under report the attacks fell to 184 and the deaths rose to 115.

19. *Tubercule of the lungs* was accountable for 730 admissions into hospital with 85 deaths. The greater prevalence and fatality of the disease amongst Gurkhas than amongst the rest of the soldiers of the Native Army is clearly brought out in the returns. Whilst for the Native Army, excluding the Gurkha Regiments, the admission rate from this disease was 3·2 and the death-rate ·43, for the Gurkha Regiments, by themselves, the admission rate was 28·9 and the death-rate 2·8 per thousand of strength; that is to say, the Gurkhas were nine times more liable to attack and nearly seven times more liable to die of tubercle of the lungs than the other soldiers of the Native Army. Dealing with the question of the best means for preventing, or diminishing, the destructive effects of lung diseases amongst our Gurkha soldiers, the Sanitary Commissioner says: "There can be little question of the advisability of moving as many of the "men as possible to the plains during the winter; life in the open air and nights passed under "canvas or in permeable huts, given ample space per unit, would certainly prove the best pre-"ventive of phthisis and other lung diseases which put such a heavy tax on the efficiency of the "Gurkha sepoy." The mortality from *pneumonia* and other *respiratory diseases* was somewhat less than in the previous year; but, between them, these diseases accounted for 36·3 per cent. of the total mortality for the year in the Native Army. The troops stationed in the Hills along the North-West and West Frontier of India suffered most.

20. The marked decrease in the ratios of sickness and mortality due to *dysentery and diarrhœa* is a noteworthy feature of the returns for the year. The admission rate from dysentery has fallen 25 per cent. and the death-rate by about 50 per cent. below the decennial means; "and, indeed, these are the lowest on record." The incidence of the disease varied widely in accordance with the part of the country occupied by the troops, and "may furnish," the Sanitary Commissioner remarks, "another instance of the fact that sickness is least prevalent where the "Sepoy is most at home."

21. The admission rate of 24·5 per thousand of strength from *venereal disease* in the Native Army for the year under report is the lowest on record. The contrast between the prevalence of this disease in the different Commands is striking. Whilst the Native soldiers serving in the Madras and Bombay Commands had 31·0 and 33·4, respectively, per thousand of their strength, admitted into hospital from venereal disease, those serving in the Bengal Command had 22·5, and those serving in the Punjab only 17·2. This comparative immunity, the Sanitary Commissioner says, is doubtless due to the fact that the men are serving close to their homes in the latter two Commands. The Gurkhas, as usual, suffered more from venereal disease than the rest of the Native Army; their admission-rate having been 38·7 per mille, as compared with only 13·6 for the troops (excluding Gurkhas) in the Punjab Command. But although the Gurkha soldier, who may be considered an alien, suffered more than the native soldier, who has his home in the country in which he is serving, he was six times less liable to contract the disease than the British soldier, who is likewise an alien. The latter, however, even in his home in Great Britain, is a victim to venereal disease far more frequently than either the French or the German soldier. Whilst our Home Army records an admission-rate from venereal disease of 122·7 per thousand of strength, the rate in France is 33·5, and in Germany only 18·1.

22. The Section on the Jails of India discusses in a very thorough manner the conditions under which the health of the prisoners, as disclosed by their vital statistics, has steadily improved during the last quarter of a century. The rate of mortality among the prison population, traced through the last four quinquennial periods of the century just closed, is seen to have fallen from 35·96, in the first of these, to 29·97 in the last. During the past three years 1901-1903, the fall in the death-rate has been much more rapid; in the first of these it was 26·87; in the second 24·85; and now, in the year under report, 21·38, or lower than the estimated death-rate of an equal number of the free population of the same ages as the prisoners. The main causes of this remarkably low death-rate in 1903 was, doubtless, the decrease in the average number of prisoners consequent upon the prosperous character of the season. The Jail population, which

had been of an average strength, during the previous eight years, of 118,485, fell in the year under report to 105,729. Not only is a season of abundant harvests accompanied by a decrease of crime and, consequently, of jail population, but the prisoners received into jail in such a year are in a better condition of health than those admitted in a year of scarcity or famine. Their smaller number, likewise, ensures them more space during their confinement, a condition in itself favourable to health.

23. As in the case of the European and Native Armies, the prison population suffered more from *cholera* during 1903 than in the previous year, but there was no serious epidemic; the total number of deaths due to it having been only 57, or 33 more than in 1902. *Small-pox* caused 6 deaths, or the same number as in the preceding year. The measures which in previous years had been successful in excluding *plague* from the jails were no less effectual during the year under report. "Of the total number of jails, 245, no less than 159 were situated in infected towns or "districts, and of these only 14 returned cases of the disease, eight jails recording only one case "each." *Enteric fever*, to judge from the number of prisoners attacked by it, was less prevalent than in the preceding year. In the year under report, the diagnosis of enteric fever was made in 45 cases, as compared with 69 in the previous year; but, whilst of the former number 25 proved fatal, only 15 were fatal in the much larger number of cases in 1902. "The disease "appeared in 28 jails, of which 21 had only one case each." And yet, seeing that the inmates of a jail are subjected to the same conditions of existence, all partaking of the same supplies of food and water, and in daily communication with each other within a limited area, one would expect that a source of infection which would give rise to one case would give rise to more than one. The enteric fever death-rate amongst prisoners differed but little from that in the Native Army. Amongst the former it was ·25 and in the latter ·22. Whilst *intermittent fever* was the cause of, by far, a higher ratio of admissions into hospital than any other disease, the chief causes of death were, as usual, *tubercle of the lungs, dysentery,* and *pneumonia.* Intermittent fever accounted for an admission rate of 363·6 per thousand of the average strength of the jail population, or 40·88 per cent. of the admissions from all causes; and, between them, tubercle of the lungs, dysentery, and pneumonia were the cause of considerably more than half the number of deaths among the prisoners during the year. From those scourges of Indian jails, *dysentery and diarrhœa,* there was a marked decrease of mortality, the combined death-rate caused by them falling to 4·66 per thousand of the jail population, as compared with 6.57 in the preceding year. The striking decrease of sickness and mortality in the jails of India is a satisfactory feature of the sanitary history of the year.

24. The subjects discussed in the remaining sections of the Report, are separately dealt with in our *memoranda* on the several Provincial Sanitary Reports, and need not be referred to again in this place.

5th June, 1905.

No. 2.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Bengal for 1903.

The Report begins with a brief but useful account of the year's rainfall. For a province covering so vast an area, no general statement regarding its rainfall would apply to every part of it. Whilst from January until May, the northern districts suffered from a deficiency of rain, the south-western districts had heavy falls during the first two months of the year. During April and May the rainfall was in defect throughout the province, except in Chota Nagpur. Following this deficiency, the temperature was excessive; the period from the middle of April, and continuing into May, having been one of the hottest on record. Monsoon conditions were established during August and rain fell, in some parts in defect and in others in excess, until its final cessation in December, which was practically a rainless month. Compared with that of the previous year, the rainfall was greater in 13 districts of the province and less in 32. "The agricultural outturn of the year under report was rather below normal, or lower than that "of last year in 25, about normal in 12, and above normal in 8 districts." The smaller yield of the harvests was, however, more than counterbalanced by the absence of any large export of grain to other provinces; with the result that the prices of the chief food grains were lower almost everywhere than in the preceding year. The comparative dryness of the season and cheaper food were favourable to the public health; and, in spite of a large increase in the mortality from plague and cholera, the total number of deaths was somewhat less than that recorded in 1902.

2. The *birth-rate*, which had been 40·14 per thousand in the previous year, fell to 39·0 in the year under report. It was, thus, 12·8 below that estimated to be "the probable true normal rate" of 51·8 per thousand of population for Bengal. It was greatly exceeded in the United Provinces of Agra and Oudh, as well as in the Central Provinces; the former recording a rate of 46·13, and the latter of 45·11. During the same year the birth-rate in England and Wales, according to the returns published by the Registrar-General, was only 28·4. In commenting on the slight decrease in the birth-rate in Bengal from 40·14, in the previous year, to 39·0 in the year under review, the Sanitary Commissioner says: "This unsatisfactory result was "undoubtedly due to the great unhealthiness of the year 1902." It may well be doubted if the slight fall in the birth-rate can be regarded as "unsatisfactory" in a country which records the deaths of 203·5 male children in the first year of life, out of every 1,000 born, and of 185·1

female children, out of every 1,000 born. In England and Wales, with their lower birth-rate, the number of infants dying during the first year of life, out of every 1,000 born, both sexes inclusive, was 132. In England and Wales a declining birth-rate is accompanied by a declining death-rate and a declining rate of infant mortality. There seems to be no reason to doubt that a decline in the birth-rate in Bengal would similarly be accompanied by a fall in the death-rate at all ages and especially amongst infants. To the unrestrained fecundity, which results in the introduction into existence of a greater number of children than their parents have the means of properly rearing, is due, more than to any other cause, the excessive infant mortality which the Government deplores. The effort to bring up children in excess of the number for which suitable provision can be made, not only leads to the waste of much infant life, but by increasing the poverty of the family, tends to enfeeble and stunt the survivors.

3. The *death-rate* remained nearly the same as in the preceding year, showing only a fractional decrease in the year under report; a rate of 33·3 was recorded against a rate of 33·43 in 1902. Although, owing, doubtless, to the comparative dryness of the year, fever was less fatal, the decrease from this cause was largely counterbalanced by increased mortality from plague and cholera. The contrast between the birth and death-rates in urban and rural circles is striking. Whilst in town areas the birth-rate, as recorded in paragraph 8 of the Report, was only 23·74 per thousand of population, in rural areas it was 39·81. With a far lower birth-rate, towns might have been expected to record a lower death-rate than the country; but, on the contrary, the death-rate recorded in town circles was 36·39 per thousand of population, and only 33·17 in rural areas. From which it may be concluded that the measures taken to improve the sanitary condition of the towns, but not yet generally extended to rural areas, have failed to compensate for the site-crowding and other conditions inimical to health prevailing in towns. The Sanitary Commissioner writes: "As usual, the mortality from cholera, plague, dysentery, "and diarrhœa and other causes was higher in urban than in rural areas. This was also the "case with respiratory diseases which stand a much better chance of correct diagnosis in towns "than elsewhere." Whilst registration of deaths according to their exact causes is still so unreliable, it is unsafe to draw from the returns conclusions as to the mortality caused by each separate disease in towns, as compared with the mortality caused by the same disease in rural areas. The Sanitary Commissioner says that "fever continued to prevail with greater intensity "in rural areas owing evidently to the existence in them of the conditions favourable for the "generation and prevalence of malarial fever"; but it is probable that this may, at least in part, be due to a greater number of deaths from other causes being lumped together under the head of "fever" in the returns from villages, the inhabitants of which may be assumed to be less educated, than in the returns from towns, the inhabitants of which may be assumed to be more educated. The mortality returns for Calcutta may fairly claim to a nearer approach to accuracy than those for the other towns of the province. Comparing the former with the latter, it is seen that, whilst the death-rate of Calcutta is nearly the same as that recorded for the rest of the Bengal towns, the ratios of deaths assigned to the several diseases differ widely. In Calcutta, for example, fever is credited with a death-rate of 5·74 per thousand of population; whilst in the rest of the Bengal towns it is credited with a death-rate of 16·77. On the other hand, whilst respiratory diseases have attributed to them a death-rate of 3·99 in Calcutta, they are recorded to have been the cause of only 0·15 in the other Bengal towns. It is unlikely that differences so wide can be due to difference in the incidence of these diseases in Calcutta as compared with the other Bengal towns.

4. *Chief Diseases.*—The Sanitary Report, as noted in the Government review of it, deals, for the most part, with figures only; information as to the special causes and prevalence of disease is somewhat scanty. From *cholera* there was a serious rise in the mortality; over two hundred thousand deaths having been attributed to it as compared with just over one hundred and fifty thousand in the previous year. According to the reports of Civil Surgeons, pollution of the drinking-water supply, consequent upon the late commencement of the monsoon, is said to have been chiefly concerned in bringing about this increase. As usual, reference is made to the influence of anti-cholera inoculation in rendering the coolies annually despatched to Assam immune from the disease. The Sanitary Commissioner, in paragraph 8 of his Report, says: "The returns received from the Superintendent of Emigration, Calcutta, showing the number "of cases of cholera among uninoculated and inoculated coolie emigrants on board the steamers "proceeding from Goalundo to Dibrugarh during January to September, clearly show the "advantage of being inoculated against cholera." According to these returns, out of 2,633 uninoculated coolies, 68, or 2·58 per cent., were attacked by cholera, 16 of the cases proving fatal; while out of the 199 inoculated coolies who were on board these steamers, only four, or 2·01 per cent., got the disease, one of the patients succumbing to it. These figures do not appear to support very strongly belief in the advantages of anti-cholera inoculation; but the numbers are too small for safe conclusions to be founded on them.

5. *Small-pox*, which had prevailed "with unprecedented virulence" during 1902, was still accountable for upwards of thirty thousand deaths, giving a ratio of deaths of population, of ·40 as compared with ·70 in the previous year. After a year of high mortality from small-pox, the disease tends to die out as the unprotected subjects become fewer, owing to their having had small-pox, or having been vaccinated. In the absence of adequate vaccination, however, the unprotected will re-accumulate, and under conditions favourable to its outbreak, another epidemic will succeed the former one, its severity being determined by the proportion of the population remaining unprotected by vaccination, inoculation, or a previous attack of small-pox. The periodical recurrence of small-pox epidemics referred to in the Government review of the report on vaccination might thus find an explanation. As to the insufficiency of the protection of the people of Bengal there can be no question. Figures were given in our last year's *Memorandum* showing the number of children under one year of age annually vaccinated and the number who remained unvaccinated. During the year under report, the number of children under one year

of age returned as having been successfully vaccinated was 877,810, and the number available for vaccination, but not vaccinated, 1,562,866. Such figures speak for themselves. The Lieutenant-Governor "is constrained to conclude, from the facts before him, that the Department "as at present organised, is unable to cope with the disease." The widespread prevalence of small-pox, he adds, emphasises the necessity for thorough reform.

6. The mortality from *plague* was almost double that recorded in the previous year. A striking feature of the history of the disease was its unequal distribution. In the single district of Saran no fewer than 25,571 deaths out of a total of 65,680 for the entire province, were attributed to plague, giving a ratio of 10·61 per thousand of population, as compared with the provincial ratio of ·88. Calcutta with a death-rate of 9·69, and Patna with one of 7·19 were the only other districts in which the mortality from plague was excessive. The Civil Surgeon of Saran, the district which suffered most severely, reported that when rats began to die in a village the inhabitants called for disinfection, and evacuated the village, building temporary shelters close by. This last, he says, has been done very largely throughout the district; but he adds, "generally, the attitude is marked apathy to the disease." The Magistrate of the neighbouring district of Patna, which, as already stated, was one of the chief sufferers from plague, writes: "The only efficient check is evacuation in rural areas. The people are year by year becoming "more ready to adopt this by themselves." Of anti-plague inoculation, he says, "the educated "community as a whole in Patna are shy on account of the Punjab mishap."

7. The comparative dryness of the year doubtless contributed towards a reduction in the mortality from *fever*. The ratio of deaths per thousand of population, due to this cause, which had been 23·13 in the previous year, fell in the year under report to 22·23, but was still slightly higher than the average for the ten years 1893-1902. In dealing with the question of fever prevalence, the Lieutenant-Governor thinks that the people generally, even those who are educated, including Europeans and many medical officers, do not yet appear to have grasped the importance of measures having for their object the destruction of infection-bearing mosquitos. The most feasible means of diminishing the number of mosquitos would appear to be to deprive them of their breeding places by a system of drainage. The Lieutenant-Governor fully realizes the difficulties which will have to be overcome in carrying into practice the destruction of mosquitos "in a country such as Lower Bengal, where every hollow is a tank, and every ditch "a breeding place" for these insects; but thinks that even a decrease in the malaria-infected mosquitos is an object worth striving for.

8. The mortality from *dysentery and diarrhœa* shows no great variation from year to year. The returns would indicate that these diseases are more fatal in towns than in rural areas; but they may perhaps only indicate that they are better diagnosed and more accurately recorded in towns than in the country. So far, the endeavour to separate deaths due to *respiratory diseases* from other causes of death, has not met with much success. The returns of mortality from these diseases yield the incredibly small ratio of only ·10 per thousand of population for the province as a whole. Whilst towns record a ratio of 1·02 deaths per thousand of population, from respiratory diseases, rural areas return a ratio of only ·05 from the same cause. It is unlikely that the inhabitants of towns suffer twenty times more severely from respiratory diseases than do the inhabitants of country areas. But, here again, as in the case of dysentery and diarrhœa, the greater mortality from respiratory diseases in towns as compared with the country, which the returns would indicate, is probably only apparent and may be due, in part, to better differentiation of the causes of death by the more intelligent towns' people than by the less intelligent rural population.

9. The total expenditure on *sanitary works* in towns fell somewhat short of four lakhs of rupees; but exceeded the expenditure of the previous financial year by upwards of half a lakh. On the other hand, the total amount expended on these works in rural areas shows a decrease of upwards of eighty thousand rupees. The table given in Appendix II, page xxviii, to show the effect on the public health of important drainage and water-supply schemes carried out in Bengal, might lead to the conclusion that little, if any, benefit has followed the execution of these works. In 9 of the 19 towns mentioned in the table, decreased mortality is recorded since the completion of these sanitary works; whilst in the rest increased mortality is recorded. The explanation of these unexpected results is no doubt to be found in the steady improvement which has been taking place in registration of vital statistics since 1892. Year by year deaths omitted from the returns have become fewer, with the obvious consequence that the death-rate has shown a corresponding increase over the death-rate recorded in previous years when the deaths omitted from the returns were more numerous. A promising scheme for the systematic cleansing of villages is being carried into effect in the Patna district, and appears, so far, to have yielded good results. With a view of encouraging the villagers to interest themselves in the improvement of their village water-supplies, the Government have promised to contribute grants-in-aid to the extent of one-third of the cost of works undertaken for the purpose of improving the sources of supply and removing the causes of contamination. Without the co-operation of the people, substantial and enduring progress in village sanitation need hardly be looked for.

3rd June, 1905.

No. 3.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of the United Provinces of Agra and Oudh for the year 1903.

The mortality of the year was unusually great, the death-rate rising to 40·28 per thousand of population, as compared with 32·54 in the preceding year, and with 30·91 the mean of the preceding five years. Only to a limited extent would the climatic conditions of the year appear to have been accountable for this increase. It is true that the mortality ascribed to fever and bowel complaints was considerably higher than usual, and that the late termination of the rains is considered by the Sanitary Commissioner to have affected this result; but the great rise of the year's death-rate was chiefly due to the destructive effects of two infectious diseases, plague and measles. During each of the first five months of the year rain was in defect, especially during April, when there was practically none except in the hills. The monsoon broke in June, but was at first nearly everywhere intermittent, and yielded an amount of rain much below normal. Similar conditions prevailed throughout the following month, both June and July being, in consequence, much hotter than usual. The months of August, September, and October recorded a rainfall more or less in excess of normal, unusually heavy storms of rain taking place in October over nearly the entire province, excepting a very few of the western and submontane districts. November and December were rainless.

2. A *birth-rate* of 46·13 was recorded for the year, against 45·84 for 1902, and 42·60 the mean for the previous five years. The accompanying *death-rate* was 40·28 as compared with 32·54 in the previous year, and with 30·91, the quinquennial mean. The high birth-rate was doubtless one of the contributory causes of the high death-rate; for the returns show that, of the total of 1,920,903 deaths at all ages, no fewer than 603,640, or not very far short of a third, occurred amongst infants of less than a year of age. Calculated on the number of children under a year of age living at the time of taking the last census, the infantile death-rate works out to no less than 409·93 per thousand; but calculated on the 2,200,031 births registered during the year under report, the ratio falls to 274·4. As the result of special inquiry, made in accordance with the orders of Government, for the purpose of ascertaining the cause of the high mortality amongst infants in the United Provinces, the Sanitary Commissioner shows that a wide-spread epidemic of measles, together with the respiratory and other affections so often a sequel of this disease, carried off large numbers of the very young during the year under report. The deaths from measles increased from a total of 15,292 in the previous year, to no less than 98,112 in the year under review. Plague, malaria, and small-pox, he adds, also contributed to swell the infantile death-rate. In the municipal towns of the province the death-rate amongst children under one year of age averaged 350·67 per thousand births, as compared with the provincial rate of 274·4. In several towns the number of deaths of infants did not fall far short of half the number born; and in one town, Pihani, the rate was 531·44. This town, it may be observed, also recorded the highest birth-rate. The ratio of mortality at all ages in urban areas greatly exceeded that in rural areas. In the former it reached 54·86 per thousand of population, as compared with 39·16 in the latter.

3. As usual, in the Sanitary Report of these Provinces, a return is given of deaths verified according to their causes by medical officers, medical subordinates, and medical practitioners. Of 11,228 such deaths, 1,346 are attributed to malaria fevers, 1,620 to dysentery and diarrhœa, 1,215 to pneumonia and other respiratory diseases, and 1,791 to plague. These numbers, as compared with the total mortality, are, as the Sanitary Commissioner remarks, too small to possess very much value; but taken for what they are worth, they tend to show that, in the general provincial returns, many deaths probably continue to be recorded under the head of "fever," which were in reality due to other causes. In the provincial returns, for example, fever as a cause of death has assigned to it a death-rate of 24·51 per thousand of population, against 0·58 from dysentery and diarrhœa, whereas, according to the figures furnished by medical practitioners, more of the deaths verified by them were due to the latter diseases than to fever. The extensive testing of the entries made in the birth and death registers continues to bear testimony to the comparative accuracy with which, as regards mere numbers, births and deaths are recorded in these provinces.

4. Owing mainly to an outbreak of *cholera* at the time of the dispersion of the crowds at the Great Fair at Hardwar on the 16th of April, the mortality caused by this disease showed a marked increase during the year under report; the total number of deaths ascribed to it increasing to 47,159 from 25,160 in the preceding year. A somewhat similar outbreak, followed by far more fatal consequences, occurred at the great Hardwar Fair of 1867, when the vast concourse of people had already begun to disperse after the chief bathing day. Regarding the outbreak in the year under report, the Sanitary Commissioner writes: "The great bathing day on the 13th was attended by "some 400,000 of people, and all went well until the 16th when some three-fourths of the people "had dispersed and the general sanitary arrangements were being broken up." This would seem to suggest the prudence of maintaining at these fairs the sanitary arrangements intact until after the complete dispersion of the crowds of visitors. On their way from Hardwar to visit other sacred places in the hills, the pilgrims carried with them the disease into the adjoining district of Garhwal, more especially, and to a less extent, into the more distant districts of Almora and Naini-Tal. Other streams of visitors returning to their homes carried the disease into the Punjab. The great fairs at Allahabad and Ballia passed off without mishap. At the latter of these, the assemblage on the great bathing day was estimated to number about half a million of people.

5. The mortality from *small-pox*, as in the case of the other chief diseases, showed a marked increase; the number of deaths rising from somewhat short of five thousand in the previous year, to upwards of twenty thousand in the year under report. The districts which suffered most severely belong to Oudh, where vaccination has hitherto been more backward than in the other divisions of these provinces. The returns show the number of persons vaccinated during the year under report to be nearly the same as that recorded in the previous year. The percentage of successful cases was, likewise, practically the same for both years. Commenting on the Notes on Vaccination submitted by the Sanitary Commissioner, the Government consider that, in view of the prevalence of plague, with the consequent suspicion and distrust on the part of the people, the results of the year must be regarded as satisfactory.

6. The mortality from plague was more than double that attributed to it in the previous year, the number of deaths rising to 84,499. The history of the epidemic does not, however, throw fresh light on the mode in which the disease is propagated, nor on the most effectual means of arresting its progress. A striking feature of the returns of plague mortality is the disproportion in the number of deaths caused by it in towns as compared with the country. The deaths from plague in towns yielded a ratio of 7·37 per thousand of population, as compared with 1·34 in rural areas.

7. The mortality from *fever*, *dysentery*, and *diarrhœa*, shows a considerable increase over that recorded in the previous year. Attempts have been made by civil surgeons in many localities to encourage the destruction of mosquitos and their larvæ by the addition of kerosine oil to pools of water; but with the object of combating malaria, attention has been mainly directed to the improvement of surface drainage and to affording the poorer classes greater facilities for obtaining quinine, measures, the value of which has been established beyond possibility of doubt by years of observation and experience.

8. *Sanitary Works.*—The Report of the Provincial Sanitary Engineer, which follows that of the Sanitary Commissioner, deals chiefly with the working of the water-pumping machinery of the six chief cities of the plains and of the hill sanitoria of Naini-Tal and Mussoorie. Now that the most populous towns of the province have been successfully provided with waterworks, the question of making a similar provision in the case of some of the other populous towns cannot remain long in abeyance. Of such towns there are more than a dozen with populations ranging from forty thousand to upwards of a hundred thousand, several of them favourably situated for obtaining water from the rivers on the banks of which they stand. Drainage schemes for some of these towns have already been considered and approved by the Sanitary Engineer. Experience shows that the introduction of a water supply into a town may be of doubtful benefit to the health of the inhabitants unless means are at the same time provided for the removal of the water when it has served its uses. Quoting from the Government review of the Sanitary Report:—
"The fact that the projects for improving the sanitary condition of municipalities approved "by the Sanitary Board amounts to Rs. 12,64,904, or 75 per cent. more than the corresponding "figures in 1901, is one indication of the vigour with which sanitary improvement is now being "pursued in all the important towns."

3rd June, 1905.

No. 4.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of the Punjab for 1903.

The first two months of the year were more than ordinarily fine and dry, the rainfall being generally in defect, and high temperatures prevailing towards the end of February. Unsettled and cooler weather followed in March and continued until June, which was drier and hotter than normal. The rains were, on the whole, lighter than ordinary over the Punjab in July and August, and heavier during September, the monsoon ceasing on the 19th of the latter month. A few slight showers fell in October, but during this and the following two months the weather continued fine until towards the end of December, when rain fell in the plains and heavy snow in the hills. The season thus appears to have been approximately normal, and, as might have been expected, the food grains at the principal markets remained steady, the rates being moderate, and, on the whole, rather lower than those of the preceding year. The rates of wages were practically the same as in 1902. As regards climate, rates of food and wages, the conditions do not, therefore, appear to have been unfavourable to the public health; but owing chiefly to the destructive epidemic of plague and great mortality from fever in some districts, the abnormally high death-rate of 49·0 per thousand of population was recorded.

2. The *birth-rate* was 42·9 per thousand of population or only a fraction less than that recorded for the preceding year. One would expect to find a marked decrease in the birth-rate recorded in the districts which suffered most severely from plague; but of the four with the highest plague mortality rates, varying from 24·27 in Lahore to 65·72 in Gujránwála, only one returned a birth-rate below the provincial average, and in the case of that one the rate was 42·6, or almost the same as the provincial rate. The district of Ludhiána lost from plague 71 out of every thousand of its population in the preceding year; yet in the year under report its birth-rate was 42·7, or almost the same as the provincial rate of 42·9. But all parts of a district affected by plague did not suffer alike; and the Sanitary Commissioner shows that in those circles which suffered most severely the number of births underwent a marked decrease. The

urban birth-rate recorded was four per thousand less than that recorded in the rural circles, including minor towns. The Sanitary Commissioner appears to think this may be due to defective registration, and proposes to have the point cleared up by special scrutiny of the birth and death registers in the principal towns. The return of a lower birth-rate in towns is not peculiar to the Punjab. In the United Provinces the birth-rate recorded in municipal towns was 42·88 as compared with the provincial rate of 46·13, whilst in Bengal the town birth-rate was only 23·74 as compared with the provincial rate of 39·00. Yet it might be expected that the agencies available for the registration of vital statistics in towns would be more efficient than those in rural circles. The proportion of male to female births registered in the Punjab was 110·3 of the former to every 100 of the latter. In the contiguous United Provinces the proportion was 107·5, and in Bengal 104·5 male to every 100 female births. Assuming registration to be equally efficient in all three provinces, the proportion of males to females born is thus shown to increase in passing from the south-east to the north-west of India.

3. The *death-rate* of 49·0 per thousand of population was the highest recorded by any province of India. It was in excess of that of the preceding year by 4·9, and of that of the five-year period 1898-1902 by 12·3. Fever and plague together were accountable for 35·5 of the total provincial death-rate of 49·0. The mortality of municipal towns was 52·89 per thousand of population, or 4·31 higher than that recorded in rural areas. Seeing that these towns recorded a lower birth-rate than rural areas, they might have been expected to record a lower, instead of a higher, death-rate than the latter. In reviewing the Sanitary Report, the Lieutenant-Governor thinks that, in the view of the fact that the incidence of plague in towns is reported to be considerably less than in rural areas, these figures seem to merit careful examination, and wishes that there were satisfactory evidence available to show that both in urban and rural areas the suggestive figures for fever and respiratory diseases are not due to the reporting of plague deaths under other names. A reference to the vital statistics of years prior to the epidemic prevalence of plague in the Punjab shows that the relative mortality in urban and rural areas in those years was practically the same as in the year under report, when plague accounted for 205,462 deaths. Taking, for example, 1895, the year immediately preceding the occurrence in Bombay of the first cases of plague which have led up to the present epidemic, it will be seen from the returns that the birth-rate of rural areas in the Punjab exceeded those of town circles by 4·3 per thousand of population; and that the death-rate of town circles at the same time exceeded those of rural circles by 4·9. During the year under report, the birth-rate of the 42 largest towns was less than that of rural circles by 4·0; and the death-rate higher by 4·3 per thousand of population. It would thus appear that the relation which the birth and death-rates of towns have to those of rural areas in the Punjab were approximately the same during the years before plague appeared as during those in which it prevailed in epidemic form. It is probable, however, that some of the deaths due to plague may have been registered under the head of fever or of respiratory diseases both in towns and in rural areas. Ample evidence will be found in the reports of the Health Officers of Bombay and Calcutta in support of the probability of many deaths having been hitherto ascribed to fevers, which were really due to plague. It can readily be understood that, during the period when drastic official measures were being adopted with the object of stamping out plague, some people would endeavour to evade these; concealing, or reporting as due to other causes, cases suffering or dying from plague; but now that these measures have been discontinued the people should have less inducement to submit false reports of the causes of illness or death. Moreover, it is not always easy, even for medical officers, to distinguish between certain obscure cases of plague and some kinds of fever, such as those of the remittent and relapsing types. Death due to plague might, therefore, not unfrequently be attributed to fevers by mistake rather than by design. The death-rates among infants under one year of age were considerably higher than those recorded in the preceding year. For male children this rate was 260, and for female children 270 of every thousand born; whilst in 1902 the corresponding ratios were only 233 and 241. These figures may be taken as some measure of the comparative healthiness of the two years. The proportion which the deaths of male children bear to the deaths of female children in the Punjab is worthy of note. In other provinces, the United Provinces and Bengal, for example, the death-rate amongst male infants is considerably higher than the death-rate among female infants; in the Punjab the reverse is the case, the death-rate among female infants being considerably higher than the death-rate among male infants.

4. Of the *chief diseases, cholera,* which had been in almost complete abeyance during the two preceding years, again prevailed in epidemic form and was accountable for 14,688 deaths. Two isolated and imported cases were reported in Delhi during the first week in April; but it was not until after the disease broke out at the Great Fair at Hardwar about the 13th of the month that the disease became diffused over the Punjab. During April cases occurred in 15 districts of the province, and in one of these districts the first case is said to have been that of a pilgrim returning from the Hardwar Fair. During the following three months the disease steadily increased, reaching its climax of severity in July, and declining in the following months until, in December, only two deaths were credited to it. Compared with the mortality from cholera following previous Kumbh Fairs at Hardwar, that recorded during the year under report was small, and this favourable result, the Lieutenant-Governor says, "appears to have been largely "due to the prompt and effective measures adopted by the district staffs of the Province to cope "with and obviate a spread of the disease."

5. The mortality from *small-pox* showed a further increase during the year under report, rising to 0·78 from 0·55 per thousand of population, in the previous year, and from an average of only 0·34 recorded for the previous five years. During recent years of plague prevalence in the Punjab, vaccination has had many difficulties to contend against; but, in spite of these, the returns show a considerable increase in the total number of vaccinations during the year under report as compared with the numbers recorded in either of the two preceding years. Of

the total of 581,221 successful primary vaccinations, as many as 472,669 were performed on children under one year of age. The attention paid to the protection of infants continues to be a satisfactory feature of vaccination in the Punjab, although the number successfully operated on still falls far short of the number available for vaccination. Deducting the 228,673 deaths of infants under one year of age from the 862,862 births recorded during the calendar year 1903, there remained 634,189 available for vaccination; of these 472,669 were successfully operated on, leaving 161,520 unprotected against small-pox. The accumulation year by year of so large an unvaccinated residuum would, obviously, supply abundant material for the propagation of small-pox in seasons favourable to the epidemic prevalence of the disease.

6. The province again suffered from a severe epidemic of *plague*, no fewer than 205,462 deaths having been recorded under this head. And it is very probable, as suggested in the Government review of the Sanitary Report, that the recorded number falls short of the actual number, not a few deaths due to plague, in some of its obscure forms, having probably been reported under the heads of fever or respiratory diseases. As in the previous year, the disease caused enormous loss of life in some districts whilst it passed lightly over others. In 1902 the Ludhiána district lost 71 out of every 1,000 of its population from plague alone; this year the same district lost only 12·3 per thousand of its population from that disease. On the other hand, Gujránwála, in which the mortality had been comparatively light in the previous year, suffered ten times more severely in the year under report, losing 63·0 per thousand of its population from plague. The disease reached its maximum intensity in April, during which 113,074 deaths were ascribed to it, and its minimum in August, when the number of deaths fell to only 111. From August until the end of the year the disease again slowly increased in prevalence, the deaths reported as due to it in December having been 8,416. In dealing with plague, the element of compulsion has almost entirely been eliminated; and "while Government has recognised and "provided for the obligation of rendering assistance to the inhabitants of plague-stricken towns "and villages, it has left the choice of adopting or neglecting precautionary measures almost "entirely to the people themselves." The people are still freely offered anti-plague inoculation. It is stated that during the year 325,550 inoculations were performed in the province, and that, although the results varied in different areas, taking the figures for the Province as a whole, the liability of the uninoculated to death from plague was two-and-a-half times greater than the liability of the inoculated. Although there are occasional signs that the people are awakening to a sense of the need for adopting energetic measures for combating the disease, they are said still to regard its ravages mostly with apathy.

7. The mortality due to *fever* was somewhat higher than the mean ratio for the previous five years. In the districts which suffered most, unusually heavy rainfall, in some cases accompanied by wide-spread inundations, is assigned as the cause of the excessive prevalence of the disease. The Civil Surgeon of Muzaffargarh, in which a fever death-rate of 29·7 was recorded, writes that there were "unusually heavy floods throughout the district, so much so that the "greater part of the district remained under water for several months afterwards, and as a "consequence a most severe epidemic of malarial fevers burst out after the floods." Under the conditions described, measures for the destruction of mosquitos would have to be conducted on a somewhat extensive scale to produce much result. Where such measures were tried during the year, as in the Gujránwála and Gujrát districts, their application was interfered with by the severe prevalence of plague.

8. The provincial death-rate of 0·82, recorded as due to *dysentery and diarrhœa*, was the same as in the previous year. Such a rate probably represents but a small fraction of the actual rate. These diseases would appear to be more prevalent, perhaps because better recognised, in towns than in rural circles. The death-rate per thousand of population ascribed to them in towns was 2·38, and in rural circles 0·65. Likewise, as regards the number of deaths registered under the heading of *respiratory diseases*, the wide divergence between the ratios in some districts as compared with neighbouring districts leads to the belief that this may, in part at least, be due to differences in the diagnosis of these diseases rather than to inequality of their incidence.

9. Of the *Sanitary Works* carried out during the year, perhaps none were of more importance than those having for their object the improvement and protection of the water supply. No fewer than 8,825 wells were cleaned out and 2,710 protected by parapet walls. Individually, these may be regarded as minor works; but collectively they are of vast importance and cannot but exercise a marked influence on the public health. The endeavour to stimulate village communities to take an interest in the sanitary improvement of their villages by the offer of rewards to those who can show the best results does not appear, as yet, to have met with much success. The Report of the Sanitary Engineer to Government, given as an Appendix to the Report of the Sanitary Commissioner, deals, amongst other questions, with the scheme for the biological treatment of sewage. It is evident from the Report that serious difficulties have been met with in the practical working of this method of sewage treatment; but the Engineer finds himself in a position to say that "septic tanks have given good results, so far." Special efforts have been made to encourage the use of sewage at outfalls for land irrigation. Owing to the inertia of municipalities, marked progress in this direction cannot yet be recorded; but experience in most parts of the world having proved this method of sewage disposal to be sound in principle and generally profitable from a practicable point of view, the efforts made to induce the people to adopt it may, if persevered in, reasonably be expected to prove ultimately successful.

3rd June, 1905.

No. 5.

MEMORANDUM by the ARMY SANITARY COMMISSION on the REPORT on the SANITARY ADMINISTRATION of the NORTH-WEST FRONTIER PROVINCE for the year 1903.

Measured by its death-rate, the year was less healthy than its predecessor. The rainfall of 12 inches, recorded at the registering stations of Peshawar and Dera Ismail Khan, was much greater than in the previous very dry year, when only 3·9 inches fell at the former and 6·9 at the latter. The harvests were, on the whole, good, and the prices of food cheaper than in the previous year, whilst the rate of wages remained practically the same.

2. Accompanying increased mortality, the *birth-rate* fell to 31·6 per thousand of population from 33·6 recorded in the preceding year. The falling-off was mainly due to the decrease in the number of female births. In the Province as a whole, for every 122·8 births of male children there were only 100 of female children registered. In Peshawar, the most populous district of the Province, the proportion of male to female births recorded was 136 of the former to 100 of the latter. The question of the wide divergence between the number of male as compared with the number of female births annually registered has been engaging the attention of the Chief Commissioner, who suggests that a special effort should be made to secure an exact record of the births in a selected area. This suggestion is being acted upon, and the Sanitary Commissioner promises a report on the result next year. The inquiry will, doubtless, be useful, and may throw light on other abnormal features of the returns of the vital statistics of this Province and of the Punjab, from which it has only recently been detached. In all the other provinces of India the death-rate recorded for male children under one year of age is considerably higher than the death-rate for female children of the same age. This is in accordance with what is generally regarded as a natural law. In England and Wales, according to Farr's Tables, the annual rate of mortality per thousand male children under one year of age is 205·1, and per thousand female children of the same age 154·4. In India the mortality amongst female infants approximates much more closely that amongst male infants; and in one province, the Punjab, the death-rate amongst female infants per thousand born actually exceeds the death-rate amongst male children of the same age. In the North-West Frontier Province the death-rate recorded is nearly the same amongst the infants of both sexes, being for the year under review 202·9 for males and 198·8 for females. The higher proportionate death-rate amongst female infants in India, as compared with that prevailing in England, may not be without its significance in a country in which the birth of a female child is not usually regarded as a subject for congratulation or rejoicing. In the Punjab, where the natural law, in accordance with which the rate of mortality is higher amongst male than amongst female infants, is reversed, the causes which lead to such a result seem to be deserving of investigation.

3. The rise of the *death-rate* from 24·4 in the previous year to 28·4 in the year under review was chiefly due to increased mortality from fever, small-pox, and cholera. The increased death-rate from *fever* may have been connected with the increased rainfall of the year, although Kohat, the district which recorded the highest death-rate of 26·96 per thousand of its population in the previous exceptionally dry year, records the slightly lower rate of 26·59 in the comparatively wet year under report.

4. *Small-pox* was much more fatal than in the preceding year, and was the cause of 2,694 deaths, or a death-rate of 1·35 per thousand of population, as compared with 0·54 in the previous year. In connection with the question of the abnormal number of births of male children as compared with those of female children in the Peshawar District, in which 136 of the former were registered against every 100 of the latter, it may be noted that, whilst the deaths from small-pox of males in that district numbered 896, those of females numbered 899. Vaccination made good progress in the Province during the year, the total number of operations increasing by 9·8 per cent. over the number recorded for the previous year. The increase was entirely in primary vaccination, re-vaccination showing a large decrease. The successful vaccinations were at the rate of 43·10 per thousand of the population of the province, or largely in excess of the recorded birth-rate of 31·6 for the calendar year 1903. The percentage of 91·52 successful cases in primary vaccination was not high; a result which appears to have been, to some extent, due to the low ratio of success yielded by vaseline lymph. Animal lymph was employed in the majority of cases, and yielded a percentage of 93·14 successful cases; vaseline lymph gave a percentage of success of only 79·86 in the 12,400 cases in which it was used; whilst human lymph gave better results than either of the other kinds of lymph employed, yielding a percentage of 96·73 successful cases. "Excellent work was done in Chitral, where no less than "28,353 vaccinations were performed." The ready acceptance of vaccination in this remote frontier state, into which it has only recently been introduced, is in striking contrast with the slow progress made by it in other provinces of India, where it has had to make its way against passive resistance, or open hostility of a superstitious and suspicious population.

5. *Cholera,* from which the Province was entirely free in the previous year, was accountable for 1,354 deaths during the year under report. The first cases of the disease in all the affected districts were clearly traceable, it is said, to importation. In the earlier months the importation was from Hardwar, where a severe outbreak occurred at the time the Great Fair held at that place was breaking up in the middle of April.

6. Little reliance can be placed on the returns of deaths ascribed to *bowel complaints* and to *respiratory diseases*. The death-rates of only 0·28 recorded as due to the former, and of 0·5 to the latter per thousand of the population probably represent but a fraction of the actual rates. The returns of sickness and mortality for the Native Army show the high death-rates

caused by respiratory diseases amongst the troops stationed in the North-West Frontier Provinces. To quote only a few examples: the Peshawar Native Garrison recorded, from these diseases in 1903, a death-rate of 1·54 per thousand of its average strength; that of Mardan 5·2; that of Kohat 6·08; and that of Dera Ismail Khan of 12·28. Moreover, in any comparison between the mortality amongst the troops and the general population, it has to be kept in view that the former are selected men, of sound constitution, in the prime of life and living under carefully supervised hygienic conditions; whilst the latter are of all ages from infancy to extreme old age and living under conditions less favourable to health and recovery from sickness. It may be presumed, therefore, that the high death-rate due to respiratory diseases amongst the Native troops stationed in the province is not lower amongst the general population.

7. The record of *sanitary works* executed during the year, although it does not include any of magnitude, shows that active measures are everywhere in progress to provide the population with pure water-supplies. In Peshawar, the largest town of the Province, upwards of thirteen thousand rupees were expended on extension of the water-supply, cleaning wells and maintenance of the water-works establishment; whilst in Dera Ismail Khan, the next most populous town, "all the drinking-water wells were cleaned." In the other towns of the Province, none of which has a population of twenty thousand, improvements in their water supplies and drainage were carried out as far as funds were available. Much useful sanitary inspection work was carried out by the Civil Surgeons, who, whilst on tour, visited and reported upon the sanitary condition of many towns and villages in their districts.

3rd June, 1905.

No. 6.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Burma for 1903.

A summary is given of the chief climatic conditions of the year, together with an estimate of the influence which these are believed to have exercised on the public health. The rainfall and humidity were above the normal; the former averaging in Lower Burma 151·4 inches, as compared with 125·70 in the preceding year, and with 133·58, the mean of the previous five years. Accompanying this exceptionally heavy rainfall, the maximum temperature was below, and the minimum above, the maximum and minimum recorded in the previous year. The price of the staple food grain of Lower Burma, which is rice and rice only, was higher than in 1902, and also higher than the average for the previous five years. "Prices were highest in August, "September, and October, when sickness and mortality were also at the maximum." But this rise, the Sanitary Commissioner adds, was nowhere so great in the Lower Province as to affect either reproduction or mortality. The lot of the people of Burma would appear to be anything but a hard one. "The people everywhere in the plains are well-off, food is plentiful, and the "Burman takes life easily, and, as a rule, employs Indian labour at a high rate of wages to "harvest his crop." Nearly the same description is given of the conditions of life in the neighbouring province of Assam. In both provinces, fecundity and mortality are said to be unaffected in ordinary seasons by prices of food or rates of wages. The character of the rainfall is believed, however, to have an important influence on the public health. The Sanitary Commissioner thinks it may be generally accepted that a normal monsoon produces a healthy year, and an abnormal one, in which the rainfall is excessive, an unhealthy year. To the climatic conditions accompanying the exceptionally heavy rainfall, the increased mortality of the year under report is ascribed.

2. In reviewing the Report, the Lieutenant-Governor comments on the slow progress made by the scheme for improving the registration of vital statistics. Complete returns of births and deaths are still available only for Lower Burma. In Upper Burma, which was annexed in 1886, the registration of births is limited to towns with an aggregate population of less than 300,000; but registration of deaths is now in force both in towns and in rural areas. The birth and death-rates recorded for both Upper and Lower Burma do not as yet probably furnish even an approximate measure of the actual fecundity and mortality. In a province, the population of which increased by 24 per cent. during the last ten-year intercensal period, the birth-rate of 33·54, for the year under report, is probably much below the actual rate, whilst a death-rate of only 24·13 recorded for a year, acknowledged to have been unhealthy, is probably no less understated. As regards Upper Burma, registration has made little more than a beginning. In the few towns to which the registration of births is still confined, the birth-rate of 37·48 recorded for them shows that satisfactory progress is being made; but the death-rate of 21·80, returned for the whole of Upper Burma, is of use, mostly, as indicating how much will have to be done to improve registration before reliable deductions can be drawn from the vital statistics obtained from that part of the province. Meanwhile, the Government, while acknowledging the difficulty of arranging the details in connection with the scheme for improving the system of registering vital statistics, considers it important that it "should be completed without further "delay." It is stated that, of the 28,530 towns and villages under registration in the province, 14 781, or 51·8 per cent., are shown as having had their records tested. The method adopted for such testing is not described; but, in not a few of the cases, it is probable that it was of a somewhat perfunctory nature. A house-to-house inquiry for the purpose of ascertaining the occurrence of births and deaths in a town or village is a laborious proceeding, requiring much

time and patience; but if the registers are to be subjected to a thorough test, no other method is known to be effectual. The character of the so-called testing adopted by the inspecting agencies may perhaps be inferred from the following statement: "Of the registers tested by district "officials, 0·63 were found defective. A civil officer's examination of these registers usually "only extends to the signing of the records and to the detection of clerical errors, which give "no proper idea as to the accuracy or otherwise of registration."

3. From most of the *Chief Diseases* there was increased mortality during the year under report as compared with its predecessor. *Cholera* was much more prevalent and fatal during 1903 than in the previous year—the deaths attributed to it in Lower Burma numbering 5,346 as compared with 1,844 in 1902. The deaths registered from the disease in Upper Burma numbered 2,887, but in the present backward state of registration little reliance can be placed on these figures. Of the cause, or causes, which led to this increased cholera mortality in the year under report, no explanation is attempted.

4. Of the chief diseases, *small-pox* was the only one which was less fatal than in the previous year. The ratio of deaths per thousand of population due to it was only ·23 as compared with ·72, the mean for the previous five years. The number of vaccinations performed shows an increase of 27,791 primary operations, and of 333 re-vaccinations. The percentage of success in cases of primary vaccination was only 87·20, whilst in re-vaccination it was 54·97. In paragraph 6 of the "Notes and Statistics on Vaccination in Burma for 1903-04," we read: "In the town of Rangoon 65 per cent. of the available children were protected. In this town "there was an increase of 4,632 operations, or 54 per cent. over last year's work, and over "100 per cent. on the work of 1901-02. The ratio of success was 98 per cent." This favourable account does not appear to be in complete agreement with the figures of Statement No. I. in the Appendix. In the Statement referred to, the percentage of success in primary vaccination, excluding the unknown cases, is recorded to be only 94·60, and in re-vaccination 70·96. Moreover, the total primary vaccinations number only 4,879, and of these the result was not ascertained in no fewer than 2,046 of the cases. By far the larger proportion of the season's operations consisted of re-vaccinations, these numbering 8,470; whilst the result in more than one-half of them, 4,507, was not ascertained. These discrepancies are probably due to the figures, given in the paragraph from which quotation has been made, having reference to Rangoon town as distinct from the district of the same name; but on the margin, against the paragraph in question, Appendices A and C are referred to in support of the statements therein set forth. Vaccination in Burma has much to contend against. There is said to be a strong prejudice in favour of inoculation in the districts generally; whilst the establishment employed to overcome this, and to popularize vaccination, is described as "badly educated, badly paid, and badly "disciplined." The Sanitary Commissioner truly says, efficient supervision is essential, "and "is the one indispensable condition to the successful working of the Vaccination Department." The low percentage of 87·20 successful cases in primary operations shows that there is room for improvement in the quality of the vaccine lymph employed.

5. The measures adopted by the Government for the protection of the province against *plague* have proved completely successful. Although ten imported cases were detected in the towns of Rangoon and Moulmein during the year, from none of these is the disease known to have extended to any one of the indigenous inhabitants. As observed in the Government resolution on the Sanitary Report, "This satisfactory result amply justifies the strict enforcement of the "preventive regulations."

6. The mortality due to *fever*, which the Sanitary Commissioner describes as "the great "death cause of the province," increased from a ratio of 8·86 per thousand in the previous year to 10·14 in the year under report, and was almost exactly the same as the mean of the previous five years. The death-rate attributed to fever in Lower Burma is less than that recorded for any other Indian province, excepting Madras. This might be supposed to be a result of the defective state of registration in Madras and Burma; but an examination of the returns submitted by the jails, the records of sickness and mortality in which are above suspicion, shows the death-rate among the prisoners to be in agreement with that recorded for the free population of the two provinces. This will be apparent from the statistics of the general population, given in Appendix B to Section VI of the Annual Report of the Sanitary Commissioner with the Government of India for 1902, and from those of prisoners given in Table XL of that Report. The cause of the increase in the prevalence of fever during the year under report is, no doubt, rightly attributed by the Sanitary Commissioner in main part to "the enhanced rainfall and "consequent greater humidity of the atmosphere, the more extended water-logging of the soil, "and the increased rain water lodgments on the surface." For the prevention of fever, no systematic measures were carried out for the destruction of mosquitos; but municipalities employed their conservancy establishments in filling pits and draining unnecessary collections of water. Increased facilities were also afforded the people throughout the province for the purchase of quinine.

7. The death-rate of 1·61 per thousand of population from *dysentery and diarrhœa* in Lower Burma shows some increase over that recorded for the previous year, but is slightly below the mean of the previous five years. As in the case of fevers, the annual variation in the mortality ascribed to bowel complaints appears to be influenced by the climatic conditions of the seasons, the effect of such conditions being intensified, or diminished, by the character of the sanitary environment.

8. The death-rate credited to *respiratory diseases* during the year was only ·35 per thousand of population. Such figures, it is needless to observe, can represent but a small fraction of the actual mortality due to these affections. In the case, alike of bowel complaints and respiratory diseases, the mortality attributed to them is probably much understated in the returns.

9. The *sanitary works* which absorbed the greater proportion of the municipal funds expended on sanitation were those connected with the provision of pure water supplies. The new Hlawga water-supply scheme for Rangoon was approaching completion. By replacing the supply from the Royal Lakes, which for years has been condemned as unfit for drinking purposes, the new supply is expected to do much to improve the health of the town. The waterworks for Moulmein and Prome are also in course of completion. Of the large and important city of Mandalay with its 183,816 inhabitants, the supply has long been pronounced to be objectionable, and the need for replacing it by an adequate and pure supply declared to be urgent. With the latter object in view, projects have been prepared; but none of them appears, so far, to have been taken in hand. The latest proposal is to obtain the new supply from artesian wells. Regarding this, the Sanitary Commissioner writes: "Should it, however, be decided to supply the town from "artesian wells, the liability of their pollution from surface water should not be lost sight of, "as the town of Mandalay is riddled throughout with cess-pits or well privies." The conservancy and drainage of Mandalay, also, continues to be unsatisfactory, the municipality objecting to any efficient scheme for their improvement which would involve additional taxation. "Whatever scheme may have been decided upon," writes the Sanitary Commissioner, "I would "suggest for the consideration of the Committee the adoption of the septic tank system for the "ultimate disposal of the night-soil." Under suitable conditions, and expert management, the septic tank system has, no doubt, been found to yield good results; but experience in India, as exemplified by the trials conducted under the direction of the Sanitary Engineer to the Punjab Government, shows that such results are by no means so easy of attainment as some of the accounts given of this method of sewage treatment might lead those adopting it to expect.

3rd June, 1905.

No. 7.

Memorandum by the Army Sanitary Commission on the Sanitary Report of the Central Provinces and Berar for 1903.

Hitherto separate Sanitary Reports have been submitted for the Central Provinces and for the Commissionership of Berar; but now that the latter has been absorbed by the former, one Sanitary Report suffices for both. By the annexation of Berar, the population of the Central Provinces, which was previously 9,770,567, has been raised to 12,491,909.

2. Judged by its vital statistics, the year was less healthy than the preceding one. The birth-rate decreased, whilst the death-rate increased. Of the meteorological features of the year little mention is made in the Report; but in the review of it by the Chief Commissioner it is stated, that "the character of the monsoon, which was extraordinarily heavy, caused fever to be "more prevalent among all classes." Had it not been for the severe epidemic of plague, however, which caused in the Central Provinces and Berar combined a death-rate of 4·13 per thousand of population, the Chief Commissioner thinks the year might have had some claim to be reckoned a fairly healthy one.

3. The *birth-rate* of the Central Provinces, which had been 48·29 in the previous year, decreased to 44·27; but was still the highest recorded, excepting in 1902, during the past 20 years. In Berar the decrease was more marked; the birth-rate, which was 56·9 in 1902, falling to 48·16 in the year under review. For the Central Provinces and Berar combined, the year's birth-rate was 45·11 per thousand of population; and was higher than that recorded by any other Indian province, excepting the United Provinces of Agra and Oudh. The rural continues to be considerably higher than the urban birth-rate. The birth-rate of towns for the year under report may, to some extent, have been lowered owing to the flight of a portion of their inhabitants, consequent on the plague scare; but, as the Sanitary Commissioner remarks, "doubtless the "village woman will always be more prolific than her urban sister."

4. The *death-rate* of the Central Provinces, which had been 25·82 per thousand of population in the preceding year, rose to 33·79 in the year under report, and somewhat exceeded the decennial mean of 32·44. To this large increase of mortality, plague and fever were the chief contributors; and the former of these two diseases is believed by the Sanitary Commissioner to have been the cause of a greater number of deaths than the returns would indicate. In Berar, which suffered far more severely from plague than the adjoining Central Provinces, the death-rate rose to 41·74 from 32·80 in the previous year, and from 35·3, the decennial mean. Apart, however, from the effect produced by epidemic disease, there can be no doubt that the unusually high birth-rates of the year under report and of its predecessor must likewise have had a share in raising the death-rate. When it is seen from the returns, that 563,548 children were added to the population during 1903, and that these died at the rate of 271·37 per thousand, as compared with the recorded death-rate of 35·52 at all ages, the effect of the high birth-rate in raising the provincial death-rate will be obvious. The districts which recorded the highest plague mortality were also, generally, those which recorded the highest death-rates among children under one year of age. "The conclusion is inevitable," writes the Sanitary Commissioner, "that many infants "died from plague, or from exposure and malnutrition consequent on it. Many no doubt lost "their mothers from plague, and that in most cases was probably an equivalent to a sentence "of death." The death-rate in the towns of the Central Provinces was more than double that in rural circles. In the preceding year the urban death-rate was 32·42, and in the year under report 66·33 per thousand of population. "The enormous relative increase in the urban death-"rates is due to plague."

5. Registration of vital statistics continues to receive much attention. The accounts given of the results of the checking of entries of births and deaths by Native Superintendents of Vaccination would lead to the conclusion, either that the record of vital statistics by Kotwars, or village watchmen, is extraordinarily accurate, or that the check to which the record has been subjected by the inspecting officers has not been very stringent. In paragraph 24 of the Sanitary Report, it is stated that the Police had recorded 50,267 births and 35,474 deaths, doubtless reported to them by the Kotwars. The Native Superintendents of Vaccination, in verifying these births and deaths, found that, of the former only 272 had been omitted, and 30 of the latter. In the district of Balaghat "not a single error was detected." On the other hand, Civil Surgeons tested 25,023 entries in the Kotwars' books and detected 383 omissions. The contrast between the number of omissions detected by the Native Superintendents and the number detected by the Civil Surgeons is striking. The former, in verifying a total of 85,983 births and deaths, find only 302 omissions; the latter, in verifying a total of 25,023, find 383 omissions. The number of omissions detected would thus seem to vary with the agents employed in checking the entries, and cannot, therefore, be accepted as a reliable measure of the accuracy, or inaccuracy, of the registration of vital statistics in the province.

6. Of the chief diseases, *cholera*, though somewhat more prevalent than in the preceding year, had only 437 deaths attributed to it. *Small-pox* was much less fatal than in 1902, but yet accounted for upwards of two thousand deaths in the Central Provinces. In reviewing the Sanitary Report, the Chief Commissioner is struck by the remarkably small number of deaths from small-pox in Berar. If the progress of vaccination in Berar is traced during the past 35 years, the cause of this remarkable immunity of its population from small-pox becomes clear. It is due to the efficiency of its Vaccination Department, which has succeeded in effecting a steady reduction in small-pox mortality from a ratio of 2·02 deaths per thousand of population, recorded for the five-year period commencing from 1868-69, to only 0·04 in the year under report. In the Central Provinces, of which Berar is now a division, the mean ratio of deaths from small-pox for the past five-year period is 0·39; and the ratio for the year under report 0·21; the latter rather more than five times greater than that recorded for Berar. As might have been expected, the widespread prevalence of plague interfered with the work of vaccination during the year under report, especially in Berar, which suffered much more severely from the epidemic than the Central Provinces. A breakdown at the depôt in which lymph is collected and prepared for distribution to the vaccinators was an additional misfortune, and is said to have retarded work for about a month. The effect of these adverse influences resulted in a decrease in the number of primary vaccinations in five of the six districts of Berar. In the Central Provinces, however, there was not only no falling-off in the number of persons vaccinated during the year, but a considerable increase both of primary operations and of re-vaccinations. Plague, which was so fatal in Berar, was much less severe in the Central Provinces, and, it may be assumed, interfered proportionately less with the progress of vaccination work. In paragraph 19 of the Notes on Vaccination, it is stated that "many of the Civil Surgeons complain of the new rule "introduced last year to inspect children at the people's own villages instead of collecting them "at a fixed centre." Colonel Moriarty's sole object in issuing such a rule was, doubtless, not confined to saving infants and their mothers from the hardship of long journeys to a collecting station, and sometimes of long and weary waiting there before the arrival of the inspecting officer, although this object is of itself of no small importance. Those who have had experience in such methods of inspecting the work of vaccinators cannot have taken long to discover that, not unfrequently, only the successful cases of vaccination, and such as would do credit to the vaccinators, are brought to the rendezvous; cases of unsuccessful, or doubtful, vaccination are left behind in their villages; and when the inspecting officer calls out the absentees' names from the register, he is likely to be told that they are sick, or have left their homes on a visit to relations. This explanation the inspecting officer has to accept for what it is worth, since, being at a distance from the absentees' village, he is unable by inquiry to check it. In testing the quality of the work of a vaccinator the inspection is thus shorn of much of its value. No doubt the collection of the children of several villages at a spot convenient for their inspection by the Civil Surgeon enables that officer to record a greater number of cases inspected at less cost of time and labour to himself than if he visited the several villages to which the children belonged; but this advantage is more than neutralized by the opportunity it affords the vaccinator of bringing forward only the cases of vaccination which he wishes to be seen, and of keeping away those which he thinks it desirable should not be seen by the Inspecting Officer. The unexpected examination of a vaccinator's work, case by case, in a single village, would more effectually test its quality than the inspection of the children collected from many villages at some spot away from their homes.

7. The epidemic of *plague* is described in considerable detail; but the account of its ravages in the districts which suffered most, although interesting, does not add materially to what is already known of the ways of the disease. Berar was the chief sufferer, and recorded a plague death-rate of 5·94 per thousand of its population, as compared with 3·61 in the rest of the province. Yet, these figures, the Sanitary Commissioner thinks, do not represent the full extent of the loss of life from plague. "There can be little doubt," he says, "that many deaths, "recorded under 'fevers' and 'other causes,' were really due to plague"; and he comes to the conclusion that the actual, exceeded the recorded, plague mortality by about 10 per cent. In his narrative, he gives instances of the spread of the disease by fugitives from plague-stricken towns and villages. The people, he says, have begun to realize that unless they protect themselves, the State can do but little for them. "They understand the value of evacuation, and, "in villages especially, frequently act on their own initiative when rats commence to die and "before human plague appears." Muhammadans suffer more from plague, it is said, only because they will not vacate infected houses and move into camp with the same freedom as others. Inoculation is not popular; and the Sanitary Commissioner fears the same must be said of chemical disinfection.

8. *Fever* is credited with a death-rate of 15·27 per thousand of population, for the entire province; the Berar division, taken separately, recording a rate of only 11·57. Seeing that Berar suffered more severely than the Central Provinces from plague, one would have expected a higher death-rate from fever, had many of the deaths due to the former disease been recorded under the head of the latter. Doubtless, as the Sanitary Commissioner believes, not a few plague deaths were attributed to fever; but now that the methods of coercion, by which it was formerly endeavoured to enforce plague measures, have been discontinued, the people can have no strong motive in reporting deaths from plague as having been due to other causes. There are some obscure forms of plague, which even medical men have difficulty in diagnosing; and it would be no matter for surprise if some of these found their way into the returns under such other headings as fever, or respiratory diseases. During the preceding year it was arranged that "systematic operations for the prevention of malaria would be carried out in five selected "municipal towns." The results of these operations have now been reported. In two of the five selected municipalities it is stated that "nothing special was done"; in a third, that "little "could be done owing to want of funds"; whilst in the remaining two, active measures were adopted with the object of filling up, or draining, hollows in which water might collect and serve as breeding places for mosquitos. The year was an unfortunate one for giving the experiment a fair trial, owing to the widespread prevalence of plague, which fully occupied the time and attention of Civil Surgeons. So far, the results of the action taken are said to have been indefinite; but it is proposed to persevere with the measures begun, and to extend them to other places.

9. In "a year of delayed and heavy rainfall following on a comparatively dry year, a "conjunction that usually leads to deterioration in the public health," it was to be expected that, as in the case of fever, there would also be an increase of mortality from *dysentery and diarrhœa*. In the Central Provinces, the death-rate attributed to these diseases was only 1·80; whilst in Berar it was 5·74 per thousand of population. Whether this greater mortality from dysentery and diarrhœa recorded in Berar is due to greater prevalence there of these diseases, or to more accurate registration of the causes of death, the Sanitary Commissioner is, at present, unable to say.

10. The returns of deaths ascribed to *respiratory diseases* are, as yet, probably almost, or altogether, without value. As pointed out in the Report, whilst in one district only two deaths are attributed to these diseases, in the next district, with a smaller population, the number is 1,960. "Anything approaching to accuracy," writes the Sanitary Commissioner, "is with our "present reporting agency, of course, impracticable; but variations such as this would seem to "depend on a difference in local instructions."

11. The *sanitary works* of importance carried out during the year were few in number; but much was done in the municipalities, as well as in villages, towards improving and protecting the drinking water supplies. A project has been prepared for the drainage of the town of Nagpur and only awaits execution by the municipality. The Report shows that considerable sums have been expended in the several districts on minor drainage works, and in the improvement of conservancy arrangements.

3rd June, 1905.

No. 8.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Assam for 1903.

1. In the second paragraph of the Report a useful account is given of the general meteorological features of the year. Without its being assumed that they stand to each other in the relation of cause and effect, the climatic conditions, prevailing prices of food and rates of wages are recorded side by side with the death-rates, leaving for inference the influence which the former may have had on the latter. Regarding the season's rainfall, it is stated that there was a reduction of this in all the districts dealt with in the tables of the Report. "In most districts the rainfall is noted as having been seasonable and regularly distributed." Accompanying these conditions, "the general death-rate of Assam was lowered, as were the "rates from cholera, small-pox, fevers, and bowel complaints."

2. The *birth-rate* recorded for the province was 35·57 per thousand of population, as compared with 34·21 in the preceding year. In the district of Darrang only was the birth-rate exceeded by the death-rate; and this was due not so much to a low birth-rate in that district as to an exceptionally high death-rate. The birth-rate of Darrang was 35·26, or almost the same as the provincial rate; but its death-rate was 38·10 as compared with a provincial rate of 26·55. It is noted that this was the district in which kálá-ázár was most prevalent and malignant in 1903. The recorded proportion of births of male to births of female children was 106·72 of the former to 100 of the latter. In the Surma Valley, the climatic conditions of which are practically the same as those of Lower Bengal, the proportion of male to female children born was 105·94, or not widely different from the proportion of 105·4 of the former to 100 of the latter recorded for the province of Bengal. Wide divergence between the proportion of male to female births may usually be taken to indicate defective registration. A reference to Annual Form No. I. of the Appendix shows that, of the three districts which record ratios of male births much in excess of the provincial average, two return low birth-rates of 27·81 and

of 28·04 respectively, rates so much below the standard of 45 laid down for the province, as scarcely to be capable of explanation except on the assumption that a large number of births escaped registration.

3. The *death-rate* of 26·55 for the year under report compares favourably with the previous year's rate of 29·01, and with the rate of 33·90 for the five-year period 1897-1901. In the three districts in which births and deaths are registered by paid village watchmen, the death-rates recorded are higher than those recorded in the other five districts, excepting in the case of Darrang. This is probably equivalent to saying that fewer deaths are omitted from the returns made by the paid village watchmen than from those made by the, hitherto, unpaid village headmen. "The high death-rate of Darrang, 38·22, is probably due to kálá-ázár." Seeing that this is one of the districts in which registration is left to unpaid village headmen, it may be assumed that its death-rate, although higher than that of any other district of the province, is yet understated. As observed, however, in the Government review of the Report, Darrang records an increased birth-rate as well as a high death-rate; and this may be taken to indicate improved registration. With a view to giving him a motive for the better performance of his duties of registrar of births and deaths, the Government has arranged to remunerate the hitherto unpaid *gaonbura*, or village headman, for his services. This measure may be expected to have the effect of improving registration in the five districts in which men of this class are employed up to the level, not a very high one, reached by the remaining three districts of the province. The following remarks, quoted from the Government review of the Sanitary Report, indicate the close attention which is being given to the subject of vital statistics, and the strenuous efforts being made to improve their registration. After commenting on the defective state of registration in certain municipal towns, the Government Resolution continues: "The work has "evidently been grossly neglected in Silchar, where, for the second year in succession, there "was no prosecution for failure to report vital occurrences, although special attention was drawn "to the matter in the Chief Commissioner's Resolution on the Sanitary Report for 1902."

4. From all of the *Chief Diseases* there was diminished mortality during the year under report as compared with 1902. *Cholera* was credited with a mortality of 1·58 per thousand of population, as compared with 2·40 in the previous year, and with 3·66 for the decennium 1891-1900. In one district only was the mortality excessive; and in this, the district of Nowgong, the death-rate ascribed to it was 6·61 per thousand of population. The coolies of the tea gardens in the Nowgong district suffered far less than the general population. "The comparative "immunity of the tea gardens in the Nowgong district," writes the Sanitary Commissioner, "is attributed by the Civil Surgeon to the fact that all the gardens except two are remote from "the river Kallang, to the banks of which the disease was for the most part confined; and to "the adoption by the garden managers of early and active measures of sanitation and prevention, "including in some cases the permanganating of the wells." Half the total of 22 deaths from cholera, in the 35 tea gardens liable to inspection in the Nowgong district, are stated to have occurred in the two gardens which are near the Kallang. The death-rate from cholera among immigrant tea-garden coolies was lower than for any other year on record, except the years 1902, 1893, and 1890. "The occurrence of low ratios so long ago," writes the Sanitary Commissioner, "is a warning not to be too ready to attribute low ratios nowadays to recent sanitary "improvements." Mention is not made in the Report of the prophylactic effects of the anti-cholera inoculation which some of the tea-garden coolies underwent before embarking on the steamers which conveyed them to Assam. In the Sanitary Report for the province of Bengal, it is claimed that "the number of cases of cholera among uninoculated and inoculated coolie "emigrants on board the steamers proceeding from Goalundo to Dibrugarh from January to "September clearly show the advantage of being inoculated against cholera." It would not, probably, be difficult to trace the subsequent history of inoculated coolies employed on the tea estates, or to ascertain if they had enjoyed any special immunity from cholera as compared with those who had not been inoculated.

5. The mortality from *small-pox* was unusually low. The severe epidemic of the preceding year, doubtless, greatly reduced the number of susceptible subjects, and thus contributed to the abeyance in which the disease remained during the year under report. Whilst in 1902, a death-rate of 1·26 was ascribed to small-pox, the rate for the year under report was only 0·21. The marked reduction in the number of vaccinations performed during 1903-04 might likewise, to some extent, be credited to the epidemic of the previous war. During the prevalence of small-pox the people are more willing, or at least have less objection, to allow their children to be vaccinated. Moreover, an epidemic reduces the number of persons in need of vaccination, one attack of small-pox generally rendering the survivor immune from a subsequent one.

6. During the year under report, *plague* paid its first visit to Assam. Between the appearance of the first case on the 16th of May and the last on the 3rd of July, 37 attacks, with 28 deaths, were reported. It is suggestive of the mode of introduction of the disease, that the first case appeared in the foreign grain bazaar of Dibrugarh. Most of the cases which followed also occurred in the same bazaar. "It had been noticed for a few days that rats were dying "in great numbers" in the same neighbourhood. In the combat against plague, the experience gathered in other parts of India was turned to good account in Assam: "every endeavour was "made to gain the sympathy and co-operation of the people, the result being that there was "no popular opposition" to the measures adopted for dealing with the outbreak. These measures were speedily and completely successful.

7. The mortality from *fever* was somewhat less than in the preceding year, the death-rate falling from 14·72 per thousand of population in 1902 to 14·22 in the year under report. The form of fever known as kálá-ázár had 5,033 deaths attributed to it; the lowest number recorded

under this heading during any one of the past 10 years. There would, however, appear to be still some uncertainty in the diagnosis of kálá-ázár which may affect the number of deaths ascribed to it.

8. The inquiry into the causes of the higher mortality from *dysentery* and *diarrhœa* amongst tea-garden coolies than among the general population has, so far, led to no definite conclusion. The suggestion made in our *Memorandum* for last year, that the difference might be due rather to difference of diagnosis than to greater fatality from bowel complaints amongst tea-garden coolies, would appear to have some foundation. "Both Civil Surgeons and European garden "doctors are of opinion," writes the Sanitary Commissioner, "that the return of dysentery "from tea-gardens is, in its way, quite as inaccurate as that from villages." Apparently, the *gaonbura* tends to return too many deaths under "fever," the garden baboo too many under "dysentery." But accurate information on the subject he reports to be practically unattainable.

9. No one large sanitary work was undertaken in the province in 1903, and no provincial scheme of any importance was under consideration. The question of how to give still further encouragement to the sale of quinine among the people is engaging attention; the amount sold during the year increased and decreased, except in the case of a single district, with the increase and decrease of fever mortality.

In Assam: "The local conditions are not favourable to the establishment and success of "mosquito brigades. At military stations, especially Kohima, real efforts were made, but "reduction of fever is not yet strikingly apparent."

3rd June, 1905.

No. 9.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Madras for 1903.

Preceding the Sanitary Commissioner's Report a page is given to a brief sketch of the proceedings of the Sanitary Board. Although its Report comes first in the volume, the Board's labours consist principally in examining works of sanitary improvement after these have undergone scrutiny by the Sanitary Commissioner and Sanitary Engineer. Some idea of the extent of these labours may be gathered from the number and importance of the works dealt with during the year. It is stated that there were 149 such works, estimated to cost, in the aggregate, upwards of seventeen lakhs of rupees. An alteration introduced by Government, in accordance with which works estimated to cost less than one thousand rupees shall not in future come before the Sanitary Board for consideration, will have the effect of relieving the Board of a mass of comparatively petty details hitherto thrown upon it when no work of an estimated cost exceeding two hundred rupees could be undertaken without its previous sanction. The effect of this alteration will be to expedite the execution of the smaller schemes of sanitary improvement, whilst placing more time at the disposal of the Board for the consideration of works of greater importance.

2. In the presidency as a whole the year was one of abundant rainfall, the average of the preceding ten years having been exceeded by no less than 29·6 inches. In one district only, that of Tinivelly, was the rainfall largely in defect. The favourable monsoons were followed by favourable harvests and a fall in the price of food-grains. These conditions favourably affected the public health. The birth-rate rose to 31·2 from 28·2 in the previous year, whilst the death-rate rose only to 22·2 from a mean ratio, for the previous five years, of 21·2. The increase of the death-rate was small when regarded in connection with the increase of the birth-rate. The natural increase of the population, or the number by which the births exceeded the deaths during the year, was 768,735. The increase in both the birth and the death-rate is attributed, in part, to improvement in the registration of vital statistics. This improvement, however, "the Govern-"ment regret to remark advances but slowely." That the registration of births and deaths for the presidency, as a whole, and especially as regards the rural areas, is still very defective is evident from a comparison of the birth and death-rates in municipalities with those recorded in rural circles. Whilst the births registered in municipalities yielded a birth-rate per thousand of population of 35·7, those recorded in rural circles yielded a rate of 31·2; and whilst municipalities returned a death-rate of 32·7, the rate for rural circles was only 21·5, according to Form II of the Appendix. Quoting, again, from the Government review of the Report: "In respect of the registration of deaths in municipalities the latter results obtained there as "compared with those in the districts were due partly to the registration of vital statistics being "compulsory and partly to increased attention to the subject."

3. Of the chief diseases, *cholera* showed some decrease in fatality, the death-rate due to it falling from ·8 per thousand of population in the preceding year to ·7 in the year under report. It is significant that the three towns most severely affected "have notoriously evil water supplies." The Sanitary Commissioner describes an outbreak, the origin of which is traced to the contamination of the river Adyar by the cholera discharges from a bricklayer attacked by the disease on its bank. The inhabitants of Guindy, who draw their water supplies from the Adyar, at a point about a quarter of a mile farther down the same side of the river, were attacked by cholera three days after the man was known to be suffering. The inference is, that the cholera

discharges were washed into the river by the rain which fell on the night after the bricklayer was attacked, carried down to Guindy, and there infected the inhabitants. Nothing is said of the source from which the bricklayer was infected; but, if he was a resident of the place, the circumstance of his having been infected indicates that the disease was locally existent, and this conceded, it might be a question whether he and the inhabitants of Guindy did not contract the disease from a common source. If the endeavour to trace to its exact cause an outbreak of cholera in jails or lunatic asylums, institutions immediately under the daily observation of medical officers trained in scientific methods of investigation, almost invariably ends in failure, it is but natural that the discovery of the orign of an outbreak, such as that described, amongst the general population should require for its confirmation evidence of the most convincing nature. The theory which the Sanitary Commissioner holds regarding the cholera microbe would doubtless explain much that is obscure in the history of cholera. He says: "The chances "are, irrespective of well-recognized facts following introduction to a locality, that, in certain "areas, the cholera microbe exists in water in a modified or feeble condition, and that the "epidemic appearance is due to the enhancement of its virulence following inflow of suitable "pabulum, especially from the subsoil and possibly from the surface." He adds: "the "bacteriologist has left the sanitarian with no more information than was obtained by Koch "originally as to the behaviour of the cholera microbe." In the case of the outbreak at Guindy, it is not stated if the cholera microbe was looked for and detected in the contaminated river water, which is assumed to have conveyed infection from the bricklayer to the people of Guindy.

4. The mortality from *small-pox*, as from cholera, showed a decrease as compared with that recorded in the preceding year. For the presidency as a whole the death-rate credited to this disease was only ·4 against ·7 in 1902. The comparative immunity from small-pox enjoyed by the municipal population, numbering nearly two and a half millions, can only be ascribed to the protective influence of vaccination. In all of the municipalities vaccination is compulsory, with the result that the ratio of the municipal population successfully vaccinated was equal to 49·9 per thousand, as compared with only 29·7 for the presidency as a whole; and that the death-rate from small-pox was only 0·1 per thousand in municipalities as compared with 0·4 in rural areas. The progress made by vaccination during the year under report is not considered to have been satisfactory. The numbers vaccinated show a considerable decrease as compared with the numbers vaccinated during the previous year. The chief causes assigned for the decrease in the districts in which this was greatest are insufficient, or irregular, supply of vaccine lymph, absence of vaccinators without substitutes, and non-prevalence of small-pox. So long as there is but a single Inspector of Vaccination, burdened with multifarious important duties in addition to superintending vaccination, efficient administration of the department cannot reasonably be expected. The officer in question, "being practically an educational officer, was not available, "except for sufficient time daily to see to *routine* papers of the Vaccination Department." The history of vaccination throughout India clearly shows that efficient supervision is absolutely essential to its successful promotion. Hitherto, this cannot be said to have been provided in Madras whilst the officer in charge of the Department has been so occupied with other duties as to be unable to find time to attend to more than the routine papers of the Department. Calf-to-arm vaccination yielded the highest percentage of successful cases, 98·5; this was closely followed by animal lymph in tubes and plates. In the 441,646 cases in which glycerinated lymph was used by local fund vaccinators, the percentage of success attained was only 86·9. Obviously, there is much room for improvement as regards the quality, as well as the sufficiency and regular distribution of the lymph supply.

5. To *plague* were ascribed 13,291 deaths, or 2,496 more than in the previous year. It is stated that, of these deaths, 7,088 occurred amongst males and only 6,203 amongst females. In his Report for 1902, the Sanitary Commissioner of the United Provinces of Agra and Oudh states that females died in considerably greater numbers than males, and this difference of liability to death from plague between the sexes, he thinks, "may very possibly be due to the facts that Native "females spend more time inside their houses and court-yards than do men, and moreover do not "so habitually wear shoes." In the Madras Presidency, to whatever cause due, the liability to die of plague is, on the contrary, shown by the returns to be less amongst females than amongst males. As the result of his observations, Colonel King has come to the important conclusion that it is unnecessary to adopt the theory of "recrudescence" to explain fresh outbreaks of plague in towns which had suffered from previous epidemics of the disease. "Investigation of records by "me for this purpose," he writes, "goes to prove that town after town that has been infected "has suffered solely from importation and not from recrudescence of the disease of a past season: "and that, similarly, it by no means follows that a town once infected may be visited again by "the disease."

6. *Fever*, as usual in the Madras Presidency, has ascribed to it a far lower death-rate than in the other provinces, excepting Burma. Comparing the fever death-rates in the three contiguous provinces; whilst Madras records a ratio of 8·4 deaths from fever per thousand of population, that recorded for Bombay is 14·05, and for Bengal, 22·23. How much of the difference between these figures is due to difference in the incidence of the disease, and how much to greater or less inaccuracy in the registration of deaths according to their causes in each of these provinces is uncertain; but the proportion of deaths recorded under the heading of "all "other causes" in each of the three provinces suggests that many deaths ascribed to fever in Bombay and Bengal are more correctly recorded under the head of "all other causes" in Madras. The death-rate ascribed to "all other causes" in Madras for the year under report was 10·2, in Bombay 7·82, and in Bengal 5·78. With the object of ascertaining the effect of the "conjoint "use of mosquito larvæ destruction, administration of quinine to human beings and minor "engineering works" in diminishing or extinguishing malaria, the Government of Madras has

directed that funds be allotted by local bodies for experiments in six carefully selected areas. "There are here, therefore," the Sanitary Commissioner remarks, "the elements for a thoroughly "honest trial of modern methods of dealing with malaria."

7. No new sanitary scheme of importance has been undertaken by any of the municipalities during the year, nor, in the opinion of the Sanitary Commissioner, is any such likely to be undertaken until the Government is in a position to again offer grants-in-aid. Nor in rural areas does sanitary progress appear to be more marked. The education of certificated Sanitary Inspectors has been made more thorough by the addition of a course of sanitary engineering to their training. The employment of those inspectors in towns and districts cannot fail to diffuse a knowledge of the elementary principles on which the public health depends, and by degrees to teach the people to take a practical interest in local sanitary matters.

3rd June, 1905.

No. 10.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Bombay for 1903.

1. The vital statistics of the year give no indication of improvement in the health of this presidency. On the contrary, with the exception of 1900, when severe famine combined with epidemic cholera, fever, and plague to swell the mortality returns, the death-rate was higher than any recorded during the preceding ten years. The climatic conditions of the year, as far at least as can be gathered from the account given of its rainfall, do not appear to have differed widely from normal. The monsoon broke in June, but was weak in nearly all parts of the country in that month. In July, however, it gathered strength and yielded a rainfall in excess of the average. In August the fall was generally in defect in two of the divisions, and in the other two in excess in some parts and in defect in others. In the months of September and October, it is described as having been generally sufficient. Except in Gujarát, where no rain fell, there were in the other divisions more or less frequent and light, or heavy, showers in November, whilst December yielded a few cents at some stations and was rainless at the rest.

2. Excepting in the famine year 1900 and in the year succeeding it, the fecundity of which latter would naturally be affected by the conditions which prevailed during its predecessor, the number of children born was lower than that recorded in any of the preceding ten years. The unprecedented sickness and mortality caused by plague doubtless contributed to diminish the birth-rate of the year; but, as pointed out in the Government review of the Report, "in view "of the opinion that the decrease of the birth-rate in Gujarát is to be ascribed to the incidence "of plague, it is remarkable that the birth-rate has been least affected in those districts where "the incidence of plague has been heaviest." It will be seen, on referring to Annual Forms I and II in the Appendix, that the three districts which recorded the highest birth-rates for the year all suffered severely from plague, Ahmadnagar with the highest birth-rate of all, 43·30, recording from plague alone a death-rate of 25·63 per thousand of its population. On the other hand, of the three districts which recorded the highest death-rates from plague none recorded a birth-rate below the general provincial rate of 31·22. As usual, the six Sind districts yield abnormally low birth-rates, none of these latter reaching 30, and two of them falling below 20 per thousand of population. In the two districts mentioned, the proportion of male to female births is 134·66 to 100 in the one, and 138·14 in 100 in the other. The explanation alike of the low birth-rates and of the abnormally high proportion of male to female children is doubtless to be found in defective registration.

3. The 811,525 deaths recorded during the year yield a death-rate of 43·91 per thousand of population, and exceed the number of births by 234,576. The increase in the mortality caused by plague was chiefly accountable for this high death-rate. Plague was accountable for more than a third of the total mortality of the year, and reasons are given for the belief that even this does not represent the full measure of the loss of life caused by it. The provincial mortality amongst infants of less than a year of age was, in the case of males, 219·57, and of females 206·70 of every 1,000 born; but in certain registration circles these rates were much exceeded. The principal causes to which this high infantile mortality was due are without doubt correctly ascribed by the Sanitary Commissioner to "improper and insufficient food, bad management, use "of opiates, neglect, early marriages, and debility of mothers." These causes are not confined to the Bombay Presidency, although the mortality due to some of them may have been increased during the years of unusual sickness and distress through which the province has recently been passing. In the year under report "the widespread influence of plague struck heavily at both "mothers and infants."

4. Only once during the preceding twenty years has *cholera* been in so complete abeyance. The number of deaths ascribed to it was only 1,825, giving a ratio of ·09 per thousand of population. The record of the mortality caused by the disease in preceding years shows the wide annual variations in its prevalence which are so striking features in the history of cholera. Satisfactory explanations of the causes of these variations have yet to be found. In concluding his remarks on cholera, the Sanitary Commissioner writes: "An inquiry into the influence of

" local water supplies on the propagation of the disease would have been interesting and valuable, " but until the strength of the Department in Sind is increased, scientific inquiries into the local " causes of cholera epidemics are impracticable."

5. The deaths from *small-pox* numbered only 2,732, and of these more than half occurred in the City of Bombay. The resulting death-rate from this disease, during the year under report, was 0·15 as compared with 0·23, the mean of the previous five years. In spite of the difficulties it had to contend against during a year of exceptionally severe plague prevalence, the progress made by vaccination was not unsatisfactory. The number of primary vaccine operations shows an increase over the number for the preceding year of 2·67 per cent., whilst the percentage of successful cases was as high as 98·3. On the other hand, there was a decrease of 5,309 in the number of re-vaccinations. The high percentage of success recorded in re-vaccination cases has attracted the attention of the Sanitary Commissioner, who is doubtless correct in thinking that this is probably due to preceding imperfect primary vaccination. In this presidency, humanized vaccine lymph is still used in the vast majority of cases, and the percentage of success following its use is everywhere very high, being in none of the registration circles less than 98·51 and in most of them exceeding 99 in primary vaccination. In Bombay City humanized has been entirely superseded by animal lymph. The latter is credited with a percentage of 99·01 successful cases. So far, the endeavour to preserve vaccine lymph by mixing it with glycerine or lanoline has not, to judge from results, been attended with much success. In primary vaccination the percentage of successful cases following the use of glycerinated lymph is stated to have been only 87·15, whilst lanoline paste yielded a percentage of 93·15 in one of the registration circles in which it was used, and only 84·4 in the other.

6. The mortality from *fever* has continued to diminish since 1900, when the deaths ascribed to it exceeded half a million, until, during the year under report, they were only somewhat over a quarter of a million. But whilst the classification of deaths according to their exact causes is still so defective, little reliance can be placed on these numbers. Amongst the deaths attributed in the returns to fever and respiratory diseases, there is reason to believe that not a few, really due to plague, have been included. The subject of the prevention of malarial fevers by the destruction of infection-bearing mosquitos is briefly dealt with in the report. Two medical officers appear to have organised " mosquito brigades," and both claim that the employment of these was attended with encouraging results; but no facts are given in support of this claim. Malaria, according to the report of the Deputy Sanitary Commissioner, Southern Registration District, is especially rife in the forest areas of Kánara and Dhárwár; but the reduction of mosquitos in these areas is considered to be impracticable. The distribution of quinine and the organisation of travelling dispensaries in the most malarious parts of Kánara, are the measures chiefly relied on for mitigating the severity of the fevers from which the inhabitants of those jungles suffer.

7. The mortality from *plague*, instead of decreasing, was the greatest yet recorded since the disease first appeared in Bombay towards the end of 1896. The deaths attributed to it numbered 281,269, or nearly a hundred thousand more than in the previous year. Only two of the 25 collectorates of the presidency were entirely free from the disease during the year. The same sudden fall in the number of deaths from plague, which was recorded in May and June of the previous year, was also a marked feature of its history during the same months of the year under report. As usual, the inhabitants of town circles suffered more severely than those of country circles. Whilst the death-rate from plague in districts was 13·91 per thousand of population, in towns it was 23·89; the rate for the province, as a whole, having been 15·22. A return is given of the deaths which occurred from plague amongst persons inoculated with the " anti-plague prophylactic." Those deaths number 2,156. Commenting on these figures, the Sanitary Commissioner writes: " To judge of the value of the plague prophylactic a return of " *all persons inoculated, and of those how many were subsequently attacked and died* of the " disease, is necessary. The return received from the Plague Department merely reports the " deaths amongst inoculated persons."

8. According to the returns, the mortality from *dysentery and diarrhœa*, as in the case of that from fever, has been on the decrease since 1900. The deaths ascribed to these diseases, during the year under report, numbered only 55,443, or about a fourth of the number recorded in 1900. As in the case of fevers, however, much reliance cannot be placed on these figures. The statistics annually furnished by medical practitioners in the United Provinces, and which may be assumed to be approximately accurate, support the belief that, whilst the number of deaths recorded under the head of " fever," in the returns prepared from the reports made by the village watchmen, is much exaggerated, the number recorded under the heading " dysentery " and diarrhœa " is, on the other hand, greatly understated. The table on page 18 of the Report shows that the deaths registered under the heading " other causes," which began to increase from the year 1896, when plague first appeared in the presidency and continued to increase year by year until they attained a total of 342,027 in 1900, have, since the latter year, again been decreasing until, in the year under report, they number only 144,510. The decrease is more apparent than real, however, and is mainly due to the separate registration of deaths from respiratory diseases, which, previous to the last two years, were included under the head of " other causes." During the year under report 59,349 deaths were returned as due to respiratory diseases; and if these are added to the deaths due to " other causes," the total of the latter will be raised to 203,859.

9. The continuance, with increasing virulence, of the plague epidemic, whilst demonstrating the urgent need for sanitary improvements, has depleted the funds available for their execution. Quoting from the annual report of the Sanitary Board, which met once during 1903: " With

directed that funds be allotted by local bodies for experiments in six carefully selected areas. "There are here, therefore," the Sanitary Commissioner remarks, "the elements for a thoroughly "honest trial of modern methods of dealing with malaria."

7. No new sanitary scheme of importance has been undertaken by any of the municipalities during the year, nor, in the opinion of the Sanitary Commissioner, is any such likely to be undertaken until the Government is in a position to again offer grants-in-aid. Nor in rural areas does sanitary progress appear to be more marked. The education of certificated Sanitary Inspectors has been made more thorough by the addition of a course of sanitary engineering to their training. The employment of those inspectors in towns and districts cannot fail to diffuse a knowledge of the elementary principles on which the public health depends, and by degrees to teach the people to take a practical interest in local sanitary matters.

3rd June, 1905.

No. 10.

Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Bombay for 1903.

1. The vital statistics of the year give no indication of improvement in the health of this presidency. On the contrary, with the exception of 1900, when severe famine combined with epidemic cholera, fever, and plague to swell the mortality returns, the death-rate was higher than any recorded during the preceding ten years. The climatic conditions of the year, as far at least as can be gathered from the account given of its rainfall, do not appear to have differed widely from normal. The monsoon broke in June, but was weak in nearly all parts of the country in that month. In July, however, it gathered strength and yielded a rainfall in excess of the average. In August the fall was generally in defect in two of the divisions, and in the other two in excess in some parts and in defect in others. In the months of September and October, it is described as having been generally sufficient. Except in Gujarát, where no rain fell, there were in the other divisions more or less frequent and light, or heavy, showers in November, whilst December yielded a few cents at some stations and was rainless at the rest.

2. Excepting in the famine year 1900 and in the year succeeding it, the fecundity of which latter would naturally be affected by the conditions which prevailed during its predecessor, the number of children born was lower than that recorded in any of the preceding ten years. The unprecedented sickness and mortality caused by plague doubtless contributed to diminish the birth-rate of the year; but, as pointed out in the Government review of the Report, "in view "of the opinion that the decrease of the birth-rate in Gujarát is to be ascribed to the incidence "of plague, it is remarkable that the birth-rate has been least affected in those districts where "the incidence of plague has been heaviest." It will be seen, on referring to Annual Forms I and II in the Appendix, that the three districts which recorded the highest birth-rates for the year all suffered severely from plague, Ahmadnagar with the highest birth-rate of all, 43·30, recording from plague alone a death-rate of 25·63 per thousand of its population. On the other hand, of the three districts which recorded the highest death-rates from plague none recorded a birth-rate below the general provincial rate of 31·22. As usual, the six Sind districts yield abnormally low birth-rates, none of these latter reaching 30, and two of them falling below 20 per thousand of population. In the two districts mentioned, the proportion of male to female births is 134·66 to 100 in the one, and 138·14 in 100 in the other. The explanation alike of the low birth-rates and of the abnormally high proportion of male to female children is doubtless to be found in defective registration.

3. The 811,525 deaths recorded during the year yield a death-rate of 43·91 per thousand of population, and exceed the number of births by 234,576. The increase in the mortality caused by plague was chiefly accountable for this high death-rate. Plague was accountable for more than a third of the total mortality of the year, and reasons are given for the belief that even this does not represent the full measure of the loss of life caused by it. The provincial mortality amongst infants of less than a year of age was, in the case of males, 219·57, and of females 206·70 of every 1,000 born; but in certain registration circles these rates were much exceeded. The principal causes to which this high infantile mortality was due are without doubt correctly ascribed by the Sanitary Commissioner to "improper and insufficient food, bad management, use "of opiates, neglect, early marriages, and debility of mothers." These causes are not confined to the Bombay Presidency, although the mortality due to some of them may have been increased during the years of unusual sickness and distress through which the province has recently been passing. In the year under report "the widespread influence of plague struck heavily at both "mothers and infants."

4. Only once during the preceding twenty years has *cholera* been in so complete abeyance. The number of deaths ascribed to it was only 1,825, giving a ratio of ·09 per thousand of population. The record of the mortality caused by the disease in preceding years shows the wide annual variations in its prevalence which are so striking features in the history of cholera. Satisfactory explanations of the causes of these variations have yet to be found. In concluding his remarks on cholera, the Sanitary Commissioner writes: "An inquiry into the influence of

local water supplies on the propagation of the disease would have been interesting and valuable, "but until the strength of the Department in Sind is increased, scientific inquiries into the local "causes of cholera epidemics are impracticable."

5. The deaths from *small-pox* numbered only 2,732, and of these more than half occurred in the City of Bombay. The resulting death-rate from this disease, during the year under report, was 0·15 as compared with 0·23, the mean of the previous five years. In spite of the difficulties it had to contend against during a year of exceptionally severe plague prevalence, the progress made by vaccination was not unsatisfactory. The number of primary vaccine operations shows an increase over the number for the preceding year of 2·67 per cent., whilst the percentage of successful cases was as high as 98·3. On the other hand, there was a decrease of 5,309 in the number of re-vaccinations. The high percentage of success recorded in re-vaccination cases has attracted the attention of the Sanitary Commissioner, who is doubtless correct in thinking that this is probably due to preceding imperfect primary vaccination. In this presidency, humanized vaccine lymph is still used in the vast majority of cases, and the percentage of success following its use is everywhere very high, being in none of the registration circles less than 98·51 and in most of them exceeding 99 in primary vaccination. In Bombay City humanized has been entirely superseded by animal lymph. The latter is credited with a percentage of 99·01 successful cases. So far, the endeavour to preserve vaccine lymph by mixing it with glycerine or lanoline has not, to judge from results, been attended with much success. In primary vaccination the percentage of successful cases following the use of glycerinated lymph is stated to have been only 87·15, whilst lanoline paste yielded a percentage of 93·15 in one of the registration circles in which it was used, and only 84·4 in the other.

6. The mortality from *fever* has continued to diminish since 1900, when the deaths ascribed to it exceeded half a million, until, during the year under report, they were only somewhat over a quarter of a million. But whilst the classification of deaths according to their exact causes is still so defective, little reliance can be placed on these numbers. Amongst the deaths attributed in the returns to fever and respiratory diseases, there is reason to believe that not a few, really due to plague, have been included. The subject of the prevention of malarial fevers by the destruction of infection-bearing mosquitos is briefly dealt with in the report. Two medical officers appear to have organised "mosquito brigades," and both claim that the employment of these was attended with encouraging results; but no facts are given in support of this claim. Malaria, according to the report of the Deputy Sanitary Commissioner, Southern Registration District, is especially rife in the forest areas of Kánara and Dhárwár; but the reduction of mosquitos in these areas is considered to be impracticable. The distribution of quinine and the organisation of travelling dispensaries in the most malarious parts of Kánara, are the measures chiefly relied on for mitigating the severity of the fevers from which the inhabitants of those jungles suffer.

7. The mortality from *plague*, instead of decreasing, was the greatest yet recorded since the disease first appeared in Bombay towards the end of 1896. The deaths attributed to it numbered 281,269, or nearly a hundred thousand more than in the previous year. Only two of the 25 collectorates of the presidency were entirely free from the disease during the year. The same sudden fall in the number of deaths from plague, which was recorded in May and June of the previous year, was also a marked feature of its history during the same months of the year under report. As usual, the inhabitants of town circles suffered more severely than those of country circles. Whilst the death-rate from plague in districts was 13·91 per thousand of population, in towns it was 23·89; the rate for the province, as a whole, having been 15·22. A return is given of the deaths which occurred from plague amongst persons inoculated with the "anti-plague prophylactic." Those deaths number 2,156. Commenting on these figures, the Sanitary Commissioner writes: "To judge of the value of the plague prophylactic a return of "*all persons inoculated, and of those how many were subsequently attacked and died* of the "disease, is necessary. The return received from the Plague Department merely reports the "deaths amongst inoculated persons."

8. According to the returns, the mortality from *dysentery and diarrhœa*, as in the case of that from fever, has been on the decrease since 1900. The deaths ascribed to these diseases, during the year under report, numbered only 55,443, or about a fourth of the number recorded in 1900. As in the case of fevers, however, much reliance cannot be placed on these figures. The statistics annually furnished by medical practitioners in the United Provinces, and which may be assumed to be approximately accurate, support the belief that, whilst the number of deaths recorded under the head of "fever," in the returns prepared from the reports made by the village watchmen, is much exaggerated, the number recorded under the heading "dysentery "and diarrhœa" is, on the other hand, greatly understated. The table on page 18 of the Report shows that the deaths registered under the heading "other causes," which began to increase from the year 1896, when plague first appeared in the presidency and continued to increase year by year until they attained a total of 342,027 in 1900, have, since the latter year, again been decreasing until, in the year under report, they number only 144,510. The decrease is more apparent than real, however, and is mainly due to the separate registration of deaths from respiratory diseases, which, previous to the last two years, were included under the head of "other causes." During the year under report 59,349 deaths were returned as due to respiratory diseases; and if these are added to the deaths due to "other causes," the total of the latter will be raised to 203,859.

9. The continuance, with increasing virulence, of the plague epidemic, whilst demonstrating the urgent need for sanitary improvements, has depleted the funds available for their execution. Quoting from the annual report of the Sanitary Board, which met once during 1903: "With

" the exception of Ahmedabad and Kárachi none of the Municipalities were in a position t
" undertake costly works, their available funds being required for minor works which had been
" postponed owing to the expenditure and loss of revenue due to plague and famine."

10. The report of the Health Officer of the Port of Bombay, attached as an appendix to the Sanitary Report, is a record of strenuous and successful effort to prevent the dissemination of infectious diseases. No fewer than 14,432 vessels of all sorts, with crews and passengers numbering 719,322, were examined during the year. The following quotation will give some idea of the variety and nature of the diseases discovered at these inspections:—" At the outward " and inward inspections, and on board vessels lying in the harbour and docks, 19 cases of " measles, 77 cases of plague, 2 cases of cholera, 238 cases of small-pox, and 1 case of scarlatina " were detected." Up to the present, no case of sleeping-sickness has been met with during these inspections.

3rd June, 1905.

No. 11.

Memorandum by the Army Sanitary Commission on the Administration Report of the Town of Calcutta for 1903–04.

The history of the Health Department for the year is disposed of in little more than four pages. This brevity is, no doubt, in part, due to the exclusion of plague from the list of diseases with which the Health Officer had to deal. " Plague was administered by a special department " independent of the Health Department." The omission from a Health Report of some account of the disease which caused more loss of life than any other seems somewhat of an anomaly. But for the prevalence of plague, the year under review would have been a comparatively healthy one. Excluding the mortality from this disease, the death-rate would not have exceeded 25·4 per thousand of population. The rainfall measured only 54·14 inches, as compared with 62·28 in the preceding year; and the mortality from fever and bowel complaints was the lowest recorded in any one of the preceding ten years. In the case of almost every article of the ordinary food of the people, there was a marked increase in the price over that which ruled in 1902-03; but the Health Officer makes no mention of any influence which either the climatic conditions or prices of foodstuffs may have exercised on the public health.

2. Calculated on the number of births registered during the year, the birth-rate was only 15·5 per thousand of population. Even when allowance is made for the disparity in the proportion of the sexes in the population of Calcutta, which consists approximately of two-thirds of males to one-third of females, the Health Officer estimates that if all the births had been recorded the birth-rate should not be less than 26 per thousand of population. With the object of improving birth registration, a new system was experimentally adopted in one district of the town for nine months, with the result that the number of births recorded during those months showed an increase of 51 per cent. The Health Officer considers the new method of registration to have been so successful in the district in which it was tried, that its extension to the other districts would be advisable.

3. The death-rate recorded was 35·1 per thousand of the population. This high death-rate is ascribed to a recrudescence of plague, excluding the mortality from which it would have been only 25·4. The mortality amongst children under one year of age was, as usual, high, reaching, as it did, a ratio of 314·3 per thousand of children of that age living. An examination of Tables IV and V of Appendix C shows remarkable differences between the birth and death-rates recorded in the several districts of the municipality. Whilst in five of these birth-rates rising from 20 to upwards of 26 per thousand of population are recorded, in other seven the rates are less than 10 per thousand. So, as regards mortality, several districts returned death-rates of less than 20 per thousand of population, and others rates exceeding 40.

4. Of the history of the plague epidemic no account is given in the report, beyond the mere record of the number of deaths ascribed to it in the returns of mortality. From these returns it appears that 8,222 persons died from this disease; a number greater than than recorded for any one year, excepting 1900, since the commencement of the present epidemic in Calcutta in 1898.

5. Sanitary improvement, as measured by diminution of mortality from *cholera*, would appear to be inappreciable. Taking the ten years preceding 1903, five of those record a number of deaths from cholera greater, and five of them a number less, than that returned for the year under report, whilst the mean number of deaths for those ten years is less than the number for the year under report. Such a record can scarcely be regarded with satisfaction, and may be contrasted with the marked reduction in the mortality from cholera which the returns show it to be possible to effect by persistent and successful endeavour to promote sanitary improvement, as exemplified in the case of the armies and jails of India. Commenting on the continued high rate of mortality from cholera in Calcutta, the Health Officer writes:—" There is very " little that can be done to check it, as it is in a large measure due to importation by pilgrims " from outside, and in the town, as Dr. Mullan, the District Health Officer, has recently collected " a number of cases to show, from the use of the water of Tolly's nullah in connection with the

"pujahs of Kalighat Temple." As noted in a previous *memorandum*, the assertion, now repeated, that the disease is brought into Calcutta from outside is unsupported by proof. Calcutta is still a notoriously insanitary town; and if the question of whether cholera is imported into Calcutta from the surrounding country or whether, on the contrary, it is spread from Calcutta into the surrounding country, is to be decided on the relative sanitary condition of the two as measured by the general death-rate, or, by what is usually regarded as a better test, the infantile death-rate, recorded in each, the probability would be in favour of the assumption that, instead of Calcutta being infected by cholera from outside, the country was infected by cholera from Calcutta. In the 24 Parganas the general death-rate amongst the population during the year under report was 31·7 per thousand, and in Calcutta 35·10. The death-rate in the former, among children under one year of age, per thousand births was 184·6, and in Calcutta 315·6. Moreover, the general death-rate in Calcutta should have been lower, instead of higher, than that recorded in the 24 Parganas, on the supposition that both were equally insanitary, seeing that the proportion of infants in the Calcutta population was far less than the proportion of infants in the 24 Parganas. The recorded birth-rate for the 24 Parganas was 32·18 and in Calcutta 15·54, or less than half; in other words, the proportion of the population of an age when death is most likely to occur was far greater in the 24 Parganas than in Calcutta. That cholera was less fatal in Calcutta than in the surrounding country was probably due to the advantage which the inhabitants of the former have over the latter, in that they enjoy a purer water supply; but the high mortality caused by the disease, notwithstanding this purer water supply, may be taken as evidence that cholera still finds in Calcutta insanitary conditions favourable to its maintaining a hold which, as yet, shows but little sign of weakening.

6. *Small-pox* was in abeyance during the year, only 50 deaths having been ascribed to it, as compared with 127 in the preceding year and with 2,997 in 1901. The progress being made by vaccination affords little guarantee that Calcutta will long escape a recurrence of one of those severe epidemics of small-pox from which it has suffered in three out of the preceding ten years. During the year under review, "the "vaccination returns again show a falling-off, on the whole, though there was a slight increase "in Districts I and III." When the Health Officer wrote his Report, Calcutta was still without the means of providing its own supplies of vaccine lymph and had to have recourse to the Madras Municipality for the purchase of "glycerised vaccine." When in communication with the Madras Municipality regarding the supply of vaccine lymph, the opportunity might be taken of becoming acquainted with the system of vaccination which has succeeded in almost extinguishing small-pox in that city. Possibly, if carried out with the same thoroughness in Calcutta, that system might be found to be no less successful than the returns of small-pox mortality prove it to have been in Madras.

7. Fewer deaths were registered under the head of *fever* than in any one of the preceding ten years. The number of deaths attributed to this cause was 4,869, as compared with 8,036, the mean for the preceding ten-year period. This decrease, the Health Officer attributes, to some extent, to the registration of more deaths under the head of "other causes"; although, apart from this, he believes there has been an appreciable diminution in malarial fever in Calcutta within the last few years. Only 51 deaths were reported to have been caused by *enteric fever*. The number of deaths due to this form of fever the Health Officer believes to be understated, "as enteric in the native is apt to pass unrecognised, and to be confused with "other febrile complaints, and it is quite exceptional for medical practitioners in the town to "notify their cases." The belief expressed by the Health Officer that there are more deaths from enteric fever than the returns would indicate seems to be founded on no exact evidence. The statistics of mortality in the Native Army and in the jails of India do not support the often-repeated opinion that enteric fever is a common cause of death amongst natives.

8. The mortality from *dysentery and diarrhœa* was less than in any one of the preceding ten years. The number of deaths attributed to these diseases was 2,677, as compared with 3,254, the mean of the preceding ten-year period. This reduction in the mortality from bowel complaints suggests improved quality of the food and water used by the people.

9. The execution of the suburban drainage scheme continues to make progress, although, as might have been expected, not without some departures from the original scheme, as well as interruptions due to the temporary stoppage of funds. It appears that the work on one sewer, "which had thus been interrupted in 1900, was not resumed till October 1903." As a result of these interruptions, parts of the completed portions of the scheme could not be brought into use until the completion of other portions on which work had been stopped.

10. The introduction of the continuous system of water supply is said to make satisfactory progress, although, for reasons stated in the Government Resolution on the Report, its extension throughout Calcutta will not be accomplished within the time originally contemplated in the Act. Chemically considered, the filtered water supply of Calcutta is stated to have maintained its character as a wholesome water. The only unsatisfactory feature connected with the tests applied to ascertain the state of purity of the water was "the continued presence of bacteria "of the Colon group, which were found in every examination of the filtered water in relatively "large numbers."

5th June, 1905.

No. 12.

Memorandum by the Army Sanitary Commission on the Administration Report of the Madras Municipality for 1903-04.

The year 1903 was comparatively healthy. The total rainfall amounted to 79·62 inches, and was in excess of the average by no less than 30·60 inches. The percentage of humidity was above normal throughout the year. Accompanying the unusual amount of rainfall and humidity the mean temperature was below the average in all the months of the year excepting the first three and October; whilst in April it was normal. "The highest temperature recorded during "the year was 103°·1 on 27th June, and the lowest 65°·3 on 8th December."

2. The *birth-rate* increased from 34·8 in the preceding year to 38·9 in the year under review, but was still below the average for the preceding decade which was 40·1. The proportion of still to live births was 3·6 of the former to every 100 of the latter. In the City of Bombay 11·1 still births to every 100 live births are recorded. No entirely satisfactory explanation has yet been given of the wide difference between the ratios of still to live births in the two cities. In another particular, also, their vital statistics show a wide divergence: whilst the ratio of births of male children to births of female children was 104·4 of the former to every 100 of the latter in Madras, it was 108·09 to every 100 in Bombay.

3. The *death-rate*, although still far higher than it should be, decreased from 42·0 per thousand of population in the previous year to 37·7 in the year under review. In two of the wards of the city the death-rate exceeded 47 per thousand of population. In both of these wards the marked insanitary conditions prevailing would sufficiently account for the excessive mortality. The divisions of the city to which these two wards belong return the highest death-rates from fevers. The infantile mortality continues high. Calculated on the number of children under one year of age living when the last census was taken, the death-rate was 411·6 per thousand; but calculated on the number of births recorded during the year it was 283·3, or considerably less than in the previous year when it was 303·9. Commenting on the high rate of mortality among children under one year of age, the Government desire that the Health Officer shall make a special investigation as to the diseases which bring it about.

4. The mortality from each of the chief diseases was below the average for the preceding ten years. *Cholera* prevailed only in sporadic form and was accountable for 28 deaths, equal to a ratio of only ·05 per thousand of population. So far back as 1893, the ratio of mortality from cholera was exactly the same, and, likewise, again in 1899. In 1900 the ratio rose to 1·3, and in the following year to 2·4. There is still much in the behaviour of this disease from year to year which is obscure; but its history in the European and Native Armies of India, as well as amongst the jail population, shows that the mortality caused by it has continued to diminish in proportion as the sanitary conditions under which the troops and prisoners live have improved. Amongst these conditions, purity of water supplies is usually reckoned to have been of chief importance; but others, such as absence of overcrowding, efficient drainage and conservancy, doubtless played their part. That the measures which have proved successful in preventing the recurrence of cholera epidemics amongst the troops and prisoners would be equally successful in preventing their recurrence amongst the general population, there is no reason to doubt. The difficulty lies in the efficient application of these measures; and until the people themselves take a more active share in the sanitation of their towns and villages than they do at present, there is little hope that the difficulty will be speedily overcome.

5. In no city of India is vaccination so efficiently carried out as in the City of Madras, and, as a result, in no city of India is the mortality from small-pox so low. The death-rate from small-pox, calculated on the seven fatal cases which occurred during the calendar year, was only 0·01, and the average death-rate for the previous ten years only 0·1. Of primary vaccination operations during the season 1903-04, there was an increase both in number and percentage of successful cases. On the other hand, re-vaccination operations decreased from 10,411 in the previous year to 7,440 during the year under report. The character of the season's work can be at once estimated from the circumstance that, of a total of 22,622 individuals who underwent primary vaccination, no fewer than 17,036 were children under one year of age. The season's report on vaccination is subjected to a searching analysis by the Government. Instructions are given for the correction of defects, and suggestions made with the object of securing more strict attention to the rules requiring vaccinated children to be brought to the vaccine depôts for inspection. To check the evasion of vaccination through abuse of the plea of ill-health, it is suggested that the Health Officer should occasionally inspect children whose vaccination has been postponed on account of illness, and satisfy himself of the necessity for the further postponement of the operation. It is pointed out that the combination of cases of primary vaccination with those of re-vaccination, in estimating the percentage of success resulting from the use of different kinds of vaccine lymph, is "misleading and without value." Of the comparatively small number of cases of primary vaccination in which lanoline lymph was used, all proved successful; next comes lymph applied direct from calf to arm, which yielded a percentage of 99·84 successful cases; and, lastly, glycerine lymph, with the slightly lower percentage of 99·35.

6. The City of Madras continued to enjoy the same remarkable immunity from *plague* as in the other years succeeding the first appearance of the disease in Bombay towards the end of 1896. During the year under report, only nine cases of plague occurred in the city, all of

them imported, and of these eight were fatal. The passport system which, as carried out in Madras, has hitherto proved so effectual in preventing the spread of infection by imported cases of plague, continues in force. Moreover, "a very considerable amount of assistance in connection with the detection of actual or suspected cases of plague was received from the public during the year."

7. The high rate of mortality which continues to be recorded from year to year amongst the inhabitants of Madras, and especially amongst its infant population, is acknowledged to be due to the serious insanitary conditions still prevailing in some divisions of the city. In no one of the wards does the death-rate fall below 30 per thousand of population, whilst in some it exceeds 40. The drainage scheme, which, according to the revised estimate, will cost not far short of fifty lakhs of rupees, is in process of execution; but the Government is not satisfied that the undertaking is being pushed forward with all the diligence which the circumstances seem to require. The number of public latrines with which the town is provided is pronounced to be quite inadequate; only one was added during the year to the number already in existence, making up the total to 226. In the absence of sufficient latrine accommodation the soil of the inhabited site, becoming more and more polluted, will remain a source of danger to the public health long after the deficiency of latrines has been made good.

5th June, 1905.

No. 13.

Memorandum by the Army Sanitary Commission on the Administration Report of the Municipal Commissioner of Bombay for the year 1903–04.

The previous year was considered by the Health Officer to be unique in the history of plague in Bombay City. The number of deaths attributed to that disease was lower than in any year since 1897, and accompanying this decrease in the mortality from plague, there was a fall in the death-rate from all causes. But the hopes of continued improvement in the health of the city, which these figures may have given rise to, have not been realised. The death-rate from plague, which had been 17·80 in 1902, has risen to 26·78 per thousand of population in the year under report, whilst the death-rate from all causes has arisen from 62·38 to 65·09.

2. The *birth-rate* of the year has moved in a direction opposite from that of the death-rate, having fallen whilst the latter has risen. This fall the Health Officer attributes "to the fact "that a large number of people had left Bombay, during the first five months of the year, owing "to the scare of plague, the mortality from which was very great during those months." Consequent upon the improvements in birth registration introduced by the Health Officer, although the births fell short of the number recorded in the preceding year by 1,224, they exceeded the average of the preceding five years by 3,332. The proportion of the still-born children to children born alive continues to be much higher in Bombay than in either of the other two presidency towns. In the year under report rather more than eleven children were still-born to every hundred born alive.

3. Of the *death-rate* of 65·09 from all causes, plague of itself was responsible for 26·78. Small-pox and measles were, likewise, much more fatal than in the preceding year. On the other hand, the deaths ascribed to fevers fell to, approximately, half the number recorded in 1902, in the case of those classed as enteric and malarial; whilst from relapsing fever the decrease was still greater, only 167 deaths having been attributed to it against 651 in the previous year. The infant mortality, although slightly less than in the previous year, was still excessive. The death-rate amongst infants was 532·29 per 1.000 births. In one of the wards of the city, Tarwadi, 423 children were born alive, and 367 deaths of children under one year of age registered, giving a death-rate of no less than 867·6 per thousand. The diseases to which the high infant mortality was chiefly due were respiratory affections and debility. To debility alone were ascribed no fewer than 2,570 deaths of children under one year of age; and of these over two thousand took place within thirty days of the time of birth. There need be little hesitation in assuming that in the case of the majority of these deaths, the "debility" assigned as the cause was due to insufficient or unsuitable nourishment, together with the absence of the careful nursing which infants need. Small-pox and measles, between them, accounted for 877 deaths of infants during the year, the former, a preventable disease, causing 436 of this total.

4. The epidemic of *plague*, so far from showing signs of abating, was more severe than in the previous year. In the year under report, 23,344 attacks, followed by 20,788 deaths, were recorded, against 16,423 attacks and 13,288 deaths in the previous year. The mortality from it continued to increase, as usual, from January until the end of March, after which it declined. The sanitary evils, which, in Bombay City, are believed specially to favour the development and spread of plague, are again described, and measures for their abatement recommended by the Health Officer, who continues: "As, however, these improvements in the sanitation of the City "will be gradual, I propose, if necessary, to ask for an increased staff of scavengers, carts, "*halalkores*, drain cleaners and gully flushing engines, and disinfectants, and as soon as the "rains cease to systematically deal with every area in which plague is likely to occur. Every "house which is overcrowded and badly lighted or ventilated will be improved. By these means

"we shall be able to determine the relation of filthy and overcrowded areas to disease." Regarding the work of the Plague Commission, appointed in 1898 to inquire into the cause, &c., of the disease, Dr. Turner, whilst admitting the published Report of the Commission to comprise much that is of value, adds: "But the actual results so far as controlling the disease or throwing "any light as to its origin, its methods of infection and measures to prevent its spread in India, "have been practically *nil*, as is instanced by the virulence of the disease during the last year "in India and Hong-Kong." He urges the need for subjecting plague to further scientific research, and outlines the direction which, in his opinion, this should take.

5. Since *plague* first secured a footing in Bombay City towards the end of 1896, the destructive effects wrought by it have been of so impressive a character, compared with those caused by the other diseases with which the people had become familiar, that the latter are apt to have less attention given to them. During the year under report, 1,477 deaths were caused by small-pox a disease acknowledged to be preventable by vaccination. It is shown by the records of mortality in the Presidency Town of Madras that, under an efficient system of vaccination, the prevalence of small-pox may be so reduced as to cease to be a serious danger to life. The Health Officer is of opinion that the work of the Vaccination Department in Bombay City "leaves much to be desired," and that stricter measures should be taken to enforce it. The heavy loss of life due to small-pox during the year gives much weight to this opinion. If the control of vaccination in Bombay City, hitherto entrusted to the Provincial Sanitary Department, were transferred to the Health Officer, who is constantly present and in a position promptly to detect and defeat attempts at evasion of the bye-laws regarding vaccination, it is probable that it would be more efficient.

6. Bombay enjoyed marked immunity from *cholera*, only 17 deaths having been ascribed to that disease during the year, whilst the mortality from *enteric* and *malarial fevers* fell to about half that recorded in the preceding year. The decrease in the number of deaths from malarial fever, including ague and remittent fever, is remarkable. In the previous year these deaths numbered 4,429, whereas in the year under report they numbered only 2,288. But it is not to be inferred from these figures that fever was only half as fatal in the year under report as during its predecessor. In remarking that the deaths from fever were much fewer than in any of the previous years since 1894, the Health Officer goes on to say: "This is due to the accurate "registration of the causes of deaths, as every death is carefully enquired into by the District "Registrar, and in many instances certificates from the medical men certifying the causes of "death are received, thus a more accurate diagnosis is obtained." It would thus appear that the marked decrease in the mortality attributed to fever is largely, if not altogether, due to more correct diagnosis of the causes of death, following upon the improved system of registration of vital statistics introduced by the Health Officer. It is worthy of note that the number of cases of enteric fever, in the returns, has decreased in almost exactly the same proportion as the number of deaths from malarial fevers. Whilst the deaths from enteric fever decreased from 89 in 1902 to 45 in the year under report, those from malarial fevers decreased from 4,429 to 2,288. It is not stated if the cause of the decrease in the number of deaths from enteric fever was due, as in the case of malarial fevers, to more accurate diagnosis, but the similar and simultaneous decrease in the mortality from both of these types of fever might suggest such an explanation.

7. There has been a notable decrease in the mortality due to *phthisis*. The deaths from this cause were fewer than in the preceding year by 1,115, and fewer than the average for the past five years by 3,223. The returns show that the time of life at which males are most liable to die of phthisis in Bombay is that between the twentieth and thirtieth years of their age, and in the case of females between the twentieth and twenty-fifth years. The death-rate from phthisis among females was more than double that among males. All rooms in which deaths from phthisis occur are disinfected, mostly by means of perchloride of mercury solution; but "light is said to be the most natural important disinfectant of the tubercle bacillus; but this," the Health Officer remarks, "is a blessing hard to obtain in the majority of our ill-ventilated "and over-crowded chawls." The measures being adopted with the object of reducing the excessive mortality from this disease in Bombay City appear, from the returns, to be meeting with success; but so long as 80 per cent. of the total population live in tenements of one room with an average of four or five occupants, as stated in the last Census Report, so long will phthisis continue to levy its annual tale of victims.

8. In the section of the Report giving an account of the administration of the Health Department, a list is given of the establishment now employed under the general direction of the Executive Health Officer. Briefly stated, the city is divided into three charges, each directly supervised by its own medical officer, with a subordinate staff of inspectors of various grades. For registration and relief of plague and other infectious diseases, there are 10 qualified medical men, 20 hospital assistants, and 10 nurses. For veterinary work and inspection of animals and milch cattle stables, there are three qualified veterinary surgeons. The labour establishment, consisting of several thousands of men and cattle, is distributed between the three main divisions of the city. During the year, a municipal laboratory was established and a municipal analyst put in charge. Much work of the utmost importance is being done in this laboratory. Of the samples of milk analysed, a large proportion were found to be adulterated with water: 13 of a total of 48 submitted for examination. Such a state of the milk-supply of the city, it is superfluous to observe, cannot fail to injuriously affect the public health, and more especially the health of the infant population, the mortality amongst which is shown by the returns to be excessive. Yet, we read: "At present the Act gives no power to prosecute any one selling "adulterated milk, but when the Act is amended this power should be rigidly enforced."

Dangerous defects in the drainage of the town are again brought under the notice of the Corporation, and suggestions made for their removal. At present, the sullage and night-soil from the house gullies is allowed to percolate into these defective drains, and there to stagnate and soak through into the subsoil. The consequent sewage-logged condition of the subsoil is considered by the Health Officer to be one of the chief causes of ill-health. A perusal of the Report impresses the reader with the conviction that the Sanitary Department of Bombay is being administered with vigour; and that a determined effort is being made, at enormous cost, to free the city from the overwhelming burden of sickness which has borne so heavily on its inhabitants since plague made its appearance amongst them in 1896.

5th June, 1905.

REPORT

ON

SANITARY MEASURES IN INDIA

IN

1905–1906.

LIBRARY
ROYAL ASIATIC SOCIETY

VOL. XXXIX.

Presented to both Houses of Parliament by Command of His Majesty.

LONDON:
PRINTED FOR HIS MAJESTY'S STATIONERY OFFICE,
By DARLING & SON, Ltd., 34-40, Bacon Street, E.

And to be purchased, either directly or through any Bookseller, from
WYMAN and SONS, Ltd., Fetter Lane, E.C.,
and 32, Abingdon Street, Westminster, S.W.;
or OLIVER & BOYD, Edinburgh;
or E. PONSONBY, 116, Grafton Street, Dublin.

1907.

[Cd. 3559.] *Price* 1*s.* 3*d.*

CONTENTS.

REPORT.

	PAGE
I. EUROPEAN ARMY:	
Sickness and mortality in 1905 ...	1
Venereal Diseases	2
Enteric and other Fevers	2
Abscess of the liver	3
Other Diseases	3
Invaliding	3
II. NATIVE ARMY:	
Sickness and mortality in 1905 ...	4
Intermittent Fever	5
Pneumonia	5
Other Diseases	5
Invaliding	5
III. GENERAL POPULATION:	
Meteorology	6
Registration of Vital Statistics ...	6
Births and Deaths	6
Chief Diseases	6
Vital Statistics of Bengal	7
„ „ City and Port of Calcutta	8
„ „ Eastern Bengal and Assam	8
„ „ United Provinces of Agra and Oudh ...	8
„ „ Punjab	9
„ „ North-West Frontier Province	10
„ „ Burma	10
„ „ Central Provinces and Berar ...	10
„ „ Madras	11
„ „ Madras City ...	11
„ „ Bombay	12
„ „ City and Port of Bombay	12
Red Sea Pilgrim Traffic	12
IV. JAILS:	
Sickness and mortality in 1905 ...	13
Chief Diseases	13
Bengal	14
Eastern Bengal and Assam	14
United Provinces of Agra and Oudh	14
Punjab	14
North-West Frontier Province ...	15
Burma	15
Central Provinces and Berar ...	15
Madras	15
Bombay	15
Andamans	16
V. VACCINATION:	
General results	17
Bengal	17
Eastern Bengal and Assam	17
United Provinces of Agra and Oudh	18
Punjab	18
North-West Frontier Province ...	18
Burma	18
Central Provinces and Berar ...	18
Madras	18
Bombay	18
VI. MEDICAL INSTITUTIONS:	
Civil Hospitals and Dispensaries:	
Institutions and Patients	19
Bengal	19
Calcutta and Howrah	19
Eastern Bengal and Assam	20
United Provinces of Agra and Oudh	20
Punjab	20
North-West Frontier Province ...	20
Burma	20
Central Provinces and Berar ...	20
Madras	20
Bombay	21
Lunatic Asylums:	
General	21
Bengal	21
Eastern Bengal and Assam ...	21
United Provinces of Agra and Oudh	21
Punjab	22
Burma	22
Central Provinces	22
Madras	22
Bombay	22
Medical Schools:	
Bengal	22
Eastern Bengal and Assam	22
United Provinces of Agra and Oudh	22
Punjab	22
Madras	23
Bombay	23
Central Research Institute, Kasauli ...	23
King Institute of Preventive Medicine, Madras	23
Pasteur Institutes	23
VII. SANITATION:	
Bengal	24
Calcutta	24
Eastern Bengal and Assam	24
United Provinces of Agra and Oudh	24
Punjab	24
North-West Frontier Province ...	25
Burma	25
Central Provinces and Berar ...	25
Madras	25
Madras City	25
Bombay	25
Bombay City	26

1625 Wt 29870 6/07 D & S 6 27625

ABSTRACT OF THE INDIA SANITARY REPORT FOR 1905.

	PAGE
Meteorology of the Year	27
European troops	31
Native troops	56
Jails	66
General population	79
History of chief diseases	90
Vaccination	107
Sanitary works	114
General remarks	119
Statistical Tables	126

INDIA OFFICE,
5th June, 1907.

ARTHUR GODLEY,
Under-Secretary of State for India.

REPORT.

The following Report on Sanitary Measures in India during the year 1905 is prepared for presentation to Parliament. It deals with the health of European and Native troops, of prisoners in jails, and of the general population; it also deals with vaccination, medical institutions, including hospitals and dispensaries, medical schools, and lunatic asylums, and with sanitation.

I.—EUROPEAN ARMY.

Sickness and mortality in 1905.

Sickness and Mortality in 1905.—In 1905, as in 1904, there was a marked improvement in the health of the European troops serving in India. The rates of admission to hospital, of constantly sick, of mortality, and of invaliding were the lowest on record. This is the more satisfactory as 52 per cent. of the strength were under 25 years of age, and 25 per cent. had less than one year's service in India. On an average strength of 71,343 the admissions into hospital were in the ratio of 834 per 1,000, against 900 in 1904, while the daily sick-rate fell from 57 to 52, and the death-rate from 10·83 to 10·05 per 1,000. The invaliding ratio (21) was lower by 14 per 1,000. The gain derived from the decrease in the number of men constantly sick alone was equal to the work of 116,435 men for a whole day. The following statement shows the sickness and mortality among European troops in the three Commands and the Secunderabad and Burma Divisions during 1905 and 1904:—

Commands.		Average Strength.	Ratio per 1,000 of Average Strength.				
			Admissions.	Constantly Sick.	Deaths.	Invaliding.	Total Loss.
Northern Command ...	1905	18,274	800	49	9·08	20	29
	1904	18,297	881	53	11·15	34	45
Western „ ...	1905	19,537	896	55	11·62	29	41
	1904	19,699	909	60	12·39	44	56
Eastern „ ...	1905	18,983	820	54	10·90	19	30
	1904	18,648	887	59	11·10	31	42
Secunderabad Division	1905	8,389	813	62	8·46	18	26
	1904	8,226	914	62	7·29	44	51
Burma „	1905	3,812	971	54	9·71	15	25
	1904	3,782	1,099	67	9·25	27	36
INDIA	1905	71,343	834	52	10·05	21	31
	1904	71,083	900	57	10·83	35	46

It will be seen from the above statement that the Northern Command had the lowest admission and constantly-sick rates, and that the Secunderabad Division had the highest sick-rate and lowest death-rate, and the Western Command the highest death-rate. In regard to mortality, there was an improvement in all the Commands. The Quetta Division had the highest admission-rate (1,024) and constantly-sick-rate (60), and the Peshawar came next, though in 1904 it had the lowest rates. The Rawalpindi and Lahore Divisions were the healthiest in 1905.

The chief causes of sickness were, as usual, venereal diseases and ague, the former yielding a ratio of 154 per 1,000 against 198 in 1904, and the latter 111 per 1,000 against 174. For the preceding decennium the admission-rate for venereal diseases had averaged 386, and for ague, 311 per 1,000. The decline in sickness is, as shown below, partly due to the new procedure in the treatment and statistical record of these diseases, and not exclusively to their diminished prevalence. Thirty-two per cent. of the total sickness resulted from these two causes. There was increased sickness from simple continued fever, influenza, and small-pox. Enteric fever and hepatic abscess were, as usual, the chief causes of mortality, but the death-rate from the former was only 2·99, as against 3·76 in 1904. Thirty per cent. of the total deaths were due to enteric fever, and 12 per cent. to hepatic abscess. Mortality from heat-stroke, pneumonia, and dysentery was higher. The chief causes of invaliding were debility, ague, tubercle of the lungs, heart complaints, and syphilis, these accounting altogether for over two-fifths of the total invaliding. The highest death-ratio was among men over 40 years of age and men of over 10 years' service. The admission-rate of European troops was nearly 40 per cent. greater than that of

native troops, while their constantly-sick rate was twice as high. The European death-rate was 10·05 and the native 8·09 per mille.

The following table shows the sickness and mortality among the European troops according to geographical groups:—

Groups.	Average Strength.	Ratio per 1,000 of Average Strength.		
		Admissions.	Constantly Sick.	Deaths.
Burma Coast and Bay Islands	1,259	1,221	52	7·15
Burma Inland	2,063	823	51	8·73
Bengal and Orissa	1,690	1,160	77	17·75
Gangetic Plain and Chutia-Nagpur	7,315	801	51	10·25
Upper Sub-Himalayan	13,724	815	53	10·27
North-Western Frontier, Indus Valley, and North-Western Rajputana	5,068	1,093	57	10·66
South-Eastern Rajputana, Central India, and Gujarat	6,562	820	53	11·89
Deccan	10,434	807	52	10·16
Western Coast	1,591	855	58	9·43
Southern India	3,738	795	55	6·42
Hill Stations	10,508	755	45	8·95
Hill Convalescent Depôts and Sanitaria ...	3,512	819	60	9·11
INDIA	71,343	834	52	10·05

Of the above 12 groups, four returned a higher admission-rate than that for the European Army as a whole, and in six groups the death-rate was higher. The most unhealthy group, judged by the admission-rate, was the Burma Coast, with a rate of 1,221 per 1,000. This group and Bengal and Orissa are always among the most unhealthy. Of the stations with a strength of over 1,000, the highest death-rates were those of Jhansi (21·03), Peshawar (18·04), Meerut (16·99), and Agra (16·58).

Venereal Diseases.—Venereal diseases ranked first in the list of causes of admission to hospital. They were the cause of 18·4 per cent. of the total sickness during 1905, and of 5·5 per cent. of the invaliding in the European Army. The admission-rate per 1,000 was 154, a lower rate than had been recorded for 30 years, and less than one-third of the maximum rate of 522 recorded in 1895. The reduction in the rates for 1905 is partly due to changes in the methods of classification, diagnosis, treatment, and statistical record, especially as regards syphilis, for which the admission-rate was only 35·6 in 1905 as against 49·1 per mille in 1904 and 79·4 in 1903, largely owing to the non-recording of patients who develop secondary symptoms after previous admission for primary syphilis and to the out-patient system of treatment. At the same time there has been a real reduction in the prevalence of these diseases. The recent steady and fairly rapid fall in the death and invaliding-rates points to the good results of more prolonged and thorough treatment. Of the Commands the highest admission-rate, viz., 166, was in the Eastern Command, followed closely by the Western Command, 155. The Northern Command, as usual, suffered least; the Burma Division most, with 207 per mille. The rates at certain stations were very high, *e.g.*, Maymyo (338), Rangoon (254), Bombay (265), Fort William (284), Bellary (264), and Madras (267). The number of men constantly sick in hospital from these diseases was 1,089 against 1,241 in the previous year; and the average stay of a case in hospital was about 36 days. The total loss of service thus involved amounted to 397,584 days. The deaths from these diseases numbered 13 (or 0·18 per mille), and the invalidings 83 (1·16 per mille), against 15 and 199 respectively in 1904. The diseases are largely due to the youth and ignorance of the soldiers and the difficulty of controlling infection outside the cantonments, and especially on the line of march between stations. Measures of prevention are taken by officers of all ranks, the principal being rigid medical inspection to detect disease, enlightenment of the soldier as to the dangers of the diseases, and endeavours to encourage games and other means of spending leisure hours pleasantly.

Fevers.—In 1905 the autumn rainfall was abnormally small, and there was exceptionally little malaria. The admission-rate from intermittent fever was less than in 1904, viz., 111 against 174, and the death-rate fell from 0·24 in 1904 to 0·11 per 1,000. The Western Command had by far the highest admission-rate, the Mhow

and Poona Divisions being especially affected. Ague accounted for 13 per cent. of the sickness from all causes as against 19 per cent. in 1904. The rate has fallen steadily since 1901, but though the decline may be due partly to more effective prophylaxis and treatment, it may also be partly owing to the classification of more cases as simple-continued fever, the admission-rate for which was greatly increased in 1904 and 1905. The admission-rates for 1901 and 1902 were 293 and 247 respectively, and the decennial rate for 1891 to 1900 was 346 per 1,000. Special reports by medical officers confirm the view that the "benign" forms of malarial fever greatly preponderate in India over the so-called "malignant" forms. A careful system of quinine treatment, isolation of malarial patients, and anti-mosquito operations were among the chief measures adopted to check malaria during the year.

The admissions for *enteric fever* were 1,146, or 16·1 per 1,000 of strength, as against 1,395, or 19·6, in 1904, and the deaths were 213 against 267, or a death-rate of 2·99 against 3·76. The constantly sick-rate was 220·5 against 256·2. The average duration of a case was 70 days, against 68 in 1904, and the total loss of service was 80,482 days against 93,769. In the Commands the sickness from enteric fever was approximately the same. Among the stations with an average strength of over 1,000 Meerut returned a death-rate of 11·68, Peshawar, 7·82, Mhow 7·09, and Jhansi, 6·69. As usual, young and unacclimatised soldiers were the chief sufferers. Among those from 20 to 25 years of age the death-rate was 4·32 per 1,000 against 5·45 in 1904, while among men between 25 and 30 and from 30 to 35 the mortality was 2·34 and 1·14 per 1,000 respectively. Of the 213 deaths from enteric fever, 70 per cent. occurred among men between 20 and 25, and 25 per cent. among men between 25 and 30. Among men of less than one year's residence in India the death-rate was 4·34 per 1,000, among men between one and two years' service 3·34, and among men between two and three years' service 3·24. During recent years the admission-rates for the higher age periods have tended to rise. Patients are now kept in hospital longer than formerly. The diminution of the disease is largely due to the prophylactic measures now in force, especially those aiming at limiting infection by contact, *e.g.*, segregation of new arrivals, early diagnosis and isolation of cases, attempts to disinfect the convalescent, and disinfection of latrines, barracks, and clothing. A standing Committee has been formed (July 1906) to investigate and advise on the incidence of enteric fever in India and its prophylaxis.

Abscess of the Liver.—From hepatic abscess there were 92 deaths, giving a ratio of 1·18 per 1,000 of strength, against 97 deaths and 1·36 per 1,000 in 1903. The mortality was far higher in the Western and Eastern than in the Northern Command.

Other Diseases.—Cholera was less prevalent, and only 10 cases were recorded with 9 deaths, against 11 fatal cases in 1904, and 57 in 1903.

Small-pox was twice as prevalent as in 1904, 99 cases with 1 death having occurred, against 49 cases and 4 deaths in 1904. Poona and Mhow were the stations chiefly affected.

The admission and death-rates from dysentery have declined in recent years, but they increased slightly in 1905, when the admission-ratio was 13·4 per 1,000 against 12·6 in 1904. The mortality was 0·46 per 1,000 against 0·42 in 1904. As regards Commands the highest place was occupied by the Western.

There were 13 cases of plague and 4 deaths, against 2 cases and no death in 1904. The total included 7 cases with 2 deaths at Aden.

Influenza was especially prevalent, the admission-rate being 14·2 per mille as against 4·9 in 1904. Peshawar was the station chiefly affected.

As regards tubercle of the lungs there were slightly lower admission and death-rates. It was most fatal in the Poona Division.

Invaliding.—The loss by invaliding during 1905 amounted to 1,508 men, equal to 21·24 per 1,000 of strength, against 2,507 or 35·27 in 1904. The invaliding rates ranged from 28·61 in the Western Command to 14·95 in the Burma Division. The most striking decreases in invaliding were in ague, tubercle of the lungs, and syphilis. Of the 116 invalided from tubercle of the lungs 98 were under 30 years of age. The number of invalidings for syphilis was 75, and for debility 152. As regards the influence of age and length of residence in India upon invalidings, 47 per cent. of the total number invalided were under 25 years of age and 82 per cent. were under 30, while 25 per cent. were of less than two years' service, and 65 per cent. were of less than five years' service.

II.—NATIVE ARMY.

Sickness and Mortality in 1905.—The health of the Native Army during 1905 was exceptionally good. The death-rate and constantly-sick-rate were the lowest on record, but the admission-rate was slightly higher than in 1904. The low death-rate is all the more noteworthy, as out of a total of 998 deaths, 185 occurred through the collapse of buildings at Dharmsala during the earthquake. The invaliding-rate was lower.

The ratios of sickness and mortality during 1905 and the previous year were as follows:—

Commands.		Average Strength.	Ratio per 1,000 of Average Strength.		
			Admissions.	Constantly Sick.	Deaths.
Northern Command	1905	36,696	652	26	12·92
	1904	40,293	609	23	7·70
Western „	1905	33,932	602	23	6·60
	1904	34,894	654	26	7·97
Eastern „	1905	21,823	572	23	6·42
	1904	22,777	545	21	6·23
Secunderabad Division	1905	11,794	466	19	5·77
	1904	14,290	437	19	6·79
Burma „	1905	4,793	614	26	6·47
	1904	6,401	564	23	6·89
INDIA	1905	123,434	607	23	8·09
	1904	124,055	603	24	8·46

In 1905 the Northern was the most unhealthy of the Commands.

The following statement gives the principal statistics of the Native Army, arranged in geographical groups, for 1905:—

Groups.	Average Strength.	Ratio per 1.000 of Average Strength.		
		Admissions.	Constantly Sick.	Deaths.
Burma Coast and Bay Islands	1,195	625	24	4·18
Burma, Inland	2,916	539	22	5·14
Assam	949	751	26	4·21
Bengal and Orissa...	2,558	877	27	5·08
Gangetic Plain and Chutia-Nagpur	7,046	506	18	5·96
Upper Sub-Himalayan	16,649	512	23	6·97
North-Western Frontier, Indus Valley, and North-Western Rajputana	17,946	664	25	7·02
South-Eastern Rajputana, Central India, and Gujarat	13,651	588	21	6·89
Deccan	15,977	445	18	4·19
Western Coast	1,978	606	29	17·69
Southern India	5,967	552	21	5·87
Hill Stations	20,224	729	31	18·05
INDIA	123,434	607	23	8·09

The chief causes of sickness were ague, dysentery, venereal diseases, and simple continued fever, pneumonia and other respiratory diseases, while pneumonia, remittent fever, and tubercle of the lungs were the chief causes of mortality.

In six of the 12 groups the constantly-sick-rate was higher than that for the whole Native Army, and in two the mortality was greater. The highest mortality was recorded by the Hill Stations group, owing to the catastrophe at Dharmsala.

Out of 36 stations with an average strength of over 1,000 in 1905, there was only one in which the sickness and mortality were heavy. At Dera Ismail Khan the admission and death-rates were 967·0 and 16·52 respectively. Most of the deaths were due to pneumonia. Comparatively low hill regions near the foot of mountain ranges are found to be unhealthy as regards both sickness and mortality. In hill stations above 5,000 feet the health of native troops compared unfavourably with that of those located in the plains.

The native troops suffered less than the European troops from influenza, small-pox, enteric fever, simple continued fever, diarrhœa, hepatic affections, and venereal diseases, but more from the other chief causes of sickness, especially dysentery, pneumonia, and plague.

Intermittent Fever.—The chief cause of sickness was, as usual, ague, which contributed 28 per cent. of the total admissions. The admission-rate, however, was only 171 per mille as against 194 in 1904. The Western Command was that principally affected. November, and not, as is usual, October, was the month of greatest prevalence.

Pneumonia.—Pneumonia was, as usual, the chief cause of death in the Native Army, and contributed 23·5 per cent. of the total deaths, the death-rate being 1·90 per 1,000 of average strength, against 2·32 in 1904. From this disease the mortality among the Native soldiers was thrice as great as that among European troops. As invariably happens, it was most prevalent among troops located on the North-West Frontier and in the Indus Valley.

Other Diseases.—There were only 11 cases of cholera with 7 deaths, as against 27 cases and 22 deaths in 1904. The admission and death ratios for enteric fever were only 1·1 and ·28 per mille respectively, as against 16·1 and 2·99 for European troops. Remittent fever accounted for 6·9 per cent. of the total mortality. Admissions for simple continued fever were more than twice as numerous as in 1904, viz., 14·3 against 6·7 per 1,000. There was a decrease of plague among the Native troops. In 1905 there were 79 cases with 46 deaths, as against 187 cases and 111 deaths in 1904. The admission-rate for tubercle of the lungs, which had been rising for many years, declined in 1904 to 3·9 per mille and to 3·1 in 1905. The disease, however, caused 6·2 per cent. of the total mortality. The admission and death-rates for dysentery, viz., 32·5 and ·18 per mille, were among the lowest on record. Venereal diseases accounted for only 19·6 per mille of the sickness. They were nearly eight times as prevalent among European as among Native troops. Their prevalence in the Native Army has declined from 42·5 per mille in 1900 to 19·6 in 1905. The Gurkhas, as usual, suffered most.

Invaliding.—The chief causes of invaliding were debility, tubercle of the lungs, rheumatism, venereal diseases, and ague. The invaliding-rate was 9·02 per 1,000 against 12·98 in 1904, the respective numbers discharged being 1,113 and 1,610.

III.—GENERAL POPULATION.

Meteorology.—The chief meteorological conditions of the year 1905 were the severity and persistency of cold weather till the end of April; the lateness and scantiness of the monsoon rains especially in North-West India, and the consequent high temperature; and the extreme weakness of the retreating monsoon over the greater part of the peninsula. The year, apart from plague, was exceptionally unhealthy, 681,299 more deaths being recorded than in 1904. The mortality from all the principal diseases increased. In all provinces, except Bombay and the Punjab, the death-rate was higher in spite of the great reduction in plague mortality.

Registration of Vital Statistics.—Registration is even now not universal, and it is compulsory only in the towns, where the municipal authorities seldom enforce the bye-law. The figures registered are not generally accurate, and the degree of accuracy differs in the various provinces. The facts are nearly everywhere collected by an unpaid and generally illiterate agency, usually by the police (except in Madras and Coorg). Accurate statistics of the causes of deaths cannot be obtained without a professional agency. It is more difficult, especially in towns, to obtain information about births than about deaths, and hence infantile mortality, which is calculated from the numbers of births and deaths of infants registered during the year, appears excessive. Further, we have to depend on the census population, because the registered returns are too inaccurate to allow of calculations of intercensal populations, with the result that as the decennium advances, rates become unduly high. Actuarial reviews of the returns of the last three censuses show that the registered birth and death rates are understated. As registration improves, the registered rates will approximate the calculated rates. A progressive increase in the registered death-rates cannot, therefore, be regarded as proving the impoverishment of the mass of the Indian people. The high Indian birth-rate is due, not to exceptional fertility, but to the large proportion of married women. The high infantile death-rate is largely due to the weakness of the children of youthful parents.

Births and Deaths.—The mean birth-rate of the population under registration, 223,124,252, was 39·13 per 1,000, against 40·86 in 1904, the birth-rates of the larger provinces ranging from 54·02 per 1,000 of population in the Central Provinces and Berar, where the birth-rates of recent years have been extraordinarily high, to 32·0 in Madras. The mean death-rate for the whole of India was 35·96 per 1,000 against 32·86 in 1904, the death-rates ranging in the various provinces from 47·55 in the Punjab to 21·4 in Madras. In the Central Provinces and Berar the birth-rate exceeded the death-rate by 16·81 per 1,000. In the Punjab and the United Provinces the birth-rate fell short of the death-rate by 3·2 and 2·76 per 1,000 respectively. The infantile death-rate ranged from 301·29 in the Central Provinces and Berar to 162·99 in Madras.

Chief Diseases.—Of the chief diseases cholera was most fatal in Eastern Bengal and Assam (death-rate 4·77 per 1,000), Bengal (2·93), and the United Provinces (2·55). The total mortality from cholera rose from 192,835 to 441,786. Small-pox was present in every province, especially in Lower Burma (death-rate 1·01) and Bombay (·92), and the mortality for India generally was 70,963 as against 55,232 in 1904. From fevers the number of deaths was higher than in 1904 by 323,674, the total being 4,417,655. The mortality was greatest in the United Provinces and Bengal, and very low in Madras and Burma. But fever is credited with many deaths really due to other diseases. Deaths from dysentery and diarrhœa rose from 273,459 to 264,124. By far the highest death-rates from these diseases were registered in the Central Provinces (3·02) and Bombay (3·0). The death-rates from respiratory diseases were highest in the Punjab (3·05) and Bombay (2·95). The year 1905 was the tenth of the present epidemic of plague in India. A decrease of 74,793 deaths occurred in the year under notice, the total being 1,069,140 in India as a whole. Of these 334,897 occurred in the Punjab and 383,802 in the United Provinces, the respective rates per 1,000 being 16·65 and 8·05. The disease was practically absent from Eastern Bengal and Assam, Coorg, and the North-West Frontier Province, while in Burma and Madras the mortality from it was relatively low. The mean plague death-rate was 4·17 per 1,000. Females suffered

from plague more than males. An Advisory Committee in England and a Commission in India are investigating the etiology of plague. Investigation tends to show that the rat plays the chief part in the spread of plague, but as there are no effectual means at present of completely destroying rats and rat fleas, the evacuation of houses infected by rats and inoculation appear to be the most effective anti-plague measures.

The deaths from the chief diseases and from all causes in the several British provinces in 1905 were as follows:—

Provinces.	Cholera.		Small-pox.		Fevers.		Dysentery and Diarrhœa.		Plague.		Deaths from all Causes.		
	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	
												1905.	1904.
Bengal	146,339	2·93	7,213	0·14	1,214,487	24·34	45,260	0·90	126,084	2·52	1,922,369	38·53	31·95*
Eastern Bengal and Assam.	142,312	4·77	4,723	0·15	706,260	23·68	25,582	0·85	6	—	1,045,305	35·06	25·85†
United Provinces of Agra and Oudh.	121,790	2·55	3,273	0·07	1,284,164	26·92	26,532	0·56	383,802	8·05	2,098,300	44·00	34·70
Punjab	2,197	0·11	4,723	0·23	370,047	18·40	13,762	0·68	334,897	16·65	956,108	47·55	49·06
North-West Frontier Province.	300	0·15	571	0·29	41,190	20·69	562	0·28	3	0·002	53,327	26·79	28·56
Central Provinces and Berar.	1,217	0·10	8,384	0·70	207,195	17·43	35,879	3·02	12,706	1·07	442,383	37·20	32·06
Lower Burma ..	3,511	0·63	5,623	0·01	49,955	8·97	7,946	1·43	3,045	0·55	138,850	24·93	22·36
Upper Burma ..	1,836	0·63	538	0·18	19,728	6·76	1,295	0·44	647	0·22	65,541‡	22·46	18·69‡
Coorg	—	—	132	0·73	3,876	21·46	96	0·53	—	—	4,739	26·24	26·62
Madras	16,888	0·50	18,540	0·50	265,044	7·20	51,298	1·40	5,788	0·20	786,123	21·40	22·50
Bombay	5,396	0·29	16,985	0·92	245,373	13·28	55,488	3·00	71,363	3·86	583,394	31·84	41·39
Ajmer-Merwara ..	—	—	277	0·58	10,336	21·67	424	0·89	2,480	5·20	16,332	34·25	27·57
Total ..	441,786	1·96	70,962	0·31	4,417,655	19·57	264,124	1·17	940,821	4·17	8,117,771	35·96	32·86

* Including statistics for Eastern Bengal. † Excluding statistics for Eastern Bengal. ‡ 12 towns only.

Bengal.

The weather of 1905 was abnormal, and conditions were unhealthy in the reconstituted province of Bengal. The rainfall was excessive and the temperature low early in the year, while the late commencement and early cessation of the monsoon rains entailed a good deal of damage to crops in the last quarter of the year. The birth-rate per 1,000 of the population, viz., 49,891,164, was 39·55. The average birth-rate in rural areas was 40·58 per 1,000 against 24·53 in towns, where low rates are due to disproportionate male populations, defective registration, &c. Registration is not universal, and although it is compulsory in towns, the bye-law is seldom enforced. Among towns Jamalpur had, as usual, the highest birth-rate (65·17).

Owing to a general increase in deaths from the principal diseases the death-rate was 38·53 per 1,000.

As regards infant mortality 216·6 per 1,000 of male and 200·4 per 1,000 of female infants born died during the first year of life. The rates of infant mortality varied from 310 per mille in Calcutta, which, as usual, had the highest mortality, to 131·8 in Darbhanga district. The infant death-rate for Bengal generally was 208·6 per mille. Leaflets in the vernacular are being distributed, containing simple instructions as to the rearing and care of infants, and as to the diet of Indian mothers after child-birth.

Taking the chief diseases seriatim, cholera was more fatal than in the preceding year, the number of deaths being 146,639 or 2·93 per 1,000, against 1·63 in 1904. The disease was present in every district. The district of Gaya suffered most severely and lost 6·63 per 1,000, while of other districts Purnea lost 5·17, Patna 5·0, and Shahabad 4·94. The contamination of wells by surface washings after a heavy rainfall is said to have been the cause of the great prevalence of the disease in Gaya. Among other precautionary measures the disinfection of wells with permanganate of potash was resorted to in 17 districts which suffered from cholera.

Small-pox, after three years of severe prevalence, greatly abated in 1904 and 1905, and the deaths fell in 1905 to 7,213 or 0·14 per 1,000. Puri and Murshidabad were the districts most affected. Out of the total small-pox deaths over 64 per cent. occurred amongst children under ten years of age.

Fever was more prevalent than in the preceding year, the mortality from it amounting to 24·34 per 1,000, against 20·49 in 1904. Over 63 per cent. of the mortality from all causes was due to fever alone, but many diseases are classed inaccurately as "fever." Mortality increased in both urban and rural areas. The highest death-rates were in the districts of Shahabad, Nadia, and Gaya. As bad

drainage is a main cause of sickness a special committee has been appointed to consider the question of drainage. The number of parcels of quinine (each containing 102 packets of seven grains) sold in 1905 was 35,472. Facilities for extending the sale are being increased.

Dysentery and diarrhœa showed a death-rate of ·90 per 1,000. The highest death-rates were recorded in Orissa, where infantile diarrhœa was extremely prevalent, and in the Howrah and Patna districts, where the respective death-rates were 4·29 and 4·19 per 1,000. The mortality was four times as great in urban as in rural areas. A special enquiry has been instituted regarding these diseases.

Plague during 1905 raged with great virulence, and carried off 126,084 persons, equal to a ratio of 2·52 per 1,000 of population. The plague death-rates were highest in the Saran and Patna districts, viz., 14·79 and 14·72 per mille respectively. The disease was much more prevalent and fatal in urban than in rural areas, and amongst females than amongst males. The plague mortality in the town of Daudnagar was 65·98 per 1,000. Rat extermination was carried on in many places. The climax of the disease was, as usual, reached in March.

City and Port of Calcutta.

The municipality of Calcutta recorded a birth-rate of 18·44 per 1,000 of population, which is an improvement on the previous year's rate of 17·9, but still far below the actual facts. The death-rate rose from 32·2 to 37·95 per 1,000. Excluding plague deaths the ratio is only 29·26. Plague showed an increase from 5·53 to 8·69. As Calcutta has a filtered water supply and a proper sewerage system, the deaths from cholera and malaria are much below those in other Bengal towns. Plague seems to be equally severe in Calcutta and the mofussil towns, while respiratory diseases appear to cause fewer deaths in the latter because they are reported as fever, &c. Small-pox occurred in severe form and the death-rate therefrom was ·32 per 1,000. The relative healthiness of Calcutta is ascribed to its comparative freedom from malarial fever, its fever death-rate in 1905 being only 5·13 as against 24·34 for Bengal as a whole.

A total of 20,339 European seamen arrived in the port of Calcutta during 1904, giving a daily average population of 1,114. There were 19 deaths, including one from cholera. Among the native floating population, estimated at 29,768, there were 128 deaths (a ratio of 4·29 per 1,000 as against 3·76 in 1903), including 33 from cholera and 20 from fever.

Eastern Bengal and Assam.

The weather was cold early in the year, while later on there was excessive rain, with floods, in some districts. The climatic conditions were, therefore, unfavourable to health. In the area under registration, with a population of 29,812,735, the births represented a ratio of 39·37 per 1,000. As usual, Goalpara had the highest district birth-rate (50·70). The registered death-rate, owing largely to the cholera epidemic, reached 35·06 per 1,000. The infant death-rate was 203·45 per 1,000.

The death-rate from cholera rose to 4·77 per 1,000, the number of deaths being 142,312. The disease raged in most of the districts bordering on the lower reaches of the Brahmaputra and Ganges and the upper portion of the Meghna, and its severity is attributed to the unusually high floods of the year. The mortality from cholera among the tea-garden coolies was 2·14 per mille.

The mortality from small-pox was low, giving a rate of only 0·15 per 1,000, the decennial rate being 0·23. The disease was most prevalent in the Kamrup district, where the death-rate was 2·78 per 1,000.

The death-rate from fevers rose slightly. In 1905 it was 23·68 per 1,000, the mortality being highest, as usual, in the Dinajpur district (36·15). From *kala-azar* 3,030 deaths were recorded. There has been a steady decrease in the mortality under this head since 1897, in which year there were 18,597 deaths from the disease, but it is believed to be more widespread than the returns indicate. A special report on *kala-azar* shows that it is distinct from malarial fever.

From dysentery and diarrhœa the death-rate was 0·85 per mille. Of the individual districts the mortality was highest in Lakhimpur (6·80) and Sibsagar (4·57), in which the tea-garden population bears a higher proportion to the total than in other districts of the Assam Valley.

Plague caused 6 deaths, all imported cases.

United Provinces of Agra and Oudh.

Climatic conditions were unfavourable to health in the United Provinces of Agra and Oudh in 1905. The birth-rate fell to 41·24 per 1,000, which was below normal. The highest district rate was 52·59 in Jhansi, and the lowest 27·86 in

Dehra Dun. The death-rate was higher than in any other province, except the Punjab. The number of registered deaths rose from 654,949 or 34·7 per 1,000 in 1904 to 2,098,300, or 44·0, in 1905, the district rates varying from 91·01 in Muttra (where the plague death-rate was 62·64), and 66·58 in Sultanpur (where the cholera death-rate was 25·30) to 26·12 in Almora, which was free from plague and cholera. The mean rural death-rate was 43·26 against 53·64 in towns, in many of which plague was severe. The infant death-rate was 263 per 1,000.

Cholera deaths rose from 6,617 or ·14 per 1,000 in 1904 to 121,790 or 2·55 in 1905. The highest mortality was in Sultanpur district (25·30 per mille), and five others were severely affected.

From small-pox the deaths fell from 6,998, or 0·15, in 1904, about the normal rate, to 3,273, or 0·07 in 1905. Eight districts were practically free from the disease.

The United Provinces had the highest provincial death-rate from fevers. The deaths attributed to fever rose from 1,141,029 or 23·92 per 1,000 in 1904 to 1,284,164, or 26·92, in 1905. The highest urban death-rate as in 1904 was in Brindaban (Muttra), while Saharanpur and Ghazipur had the highest district rates. Increased efforts are being made to improve surface drainage, to fill up hollows, and to bring quinine more generally within the reach of the poorer classes. In 1905 643,668 pice packets of quinine were sold, mostly by post offices.

The number of deaths recorded under dysentery and diarrhœa, 26,532 (·56 per 1,000) was somewhat higher than in 1904, but below the quinquennial mean. As usual, Garhwal headed the districts with a death-rate of 11·39, followed by Almora (4·20) and Ballia (3·07). The urban death-rate was five times the rural.

The mortality from plague was the highest on record, and was more than twice as great as in the previous year, the total being 383,802 or 8·05 per 1,000 as compared with 179,082 or 3·75 in 1904. The highest rates recorded in the districts were 62·64 in Muttra, 22·03 in Ghazipur, 19·94 in Allahabad, and 19·08 in Agra. Only one district (Almora) returned no death from plague. Of towns Kiratpur (Bijnor) had the highest death-rate (71·82).

Punjab.

Weather conditions in the Punjab were unfavourable, and it was the unhealthiest province in India in 1905 as in 1902, 1903, and 1904. Plague again dominated the vital statistics. Nevertheless, the mortality was below that of 1904. The birth-rate was 44·4 per 1,000 of population, or 3·0 more than that recorded in the previous year and about 4·0 above the quinquennial mean. According to districts the birth-rates ranged from 67·2 in Lyallpur to 21·4 in Simla. The death-rate was 47·6 as against 49·1 in the previous year. Among the districts Rohtak had the highest death-rate, 78·5 per 1,000. In Kangra, where 1,374 persons lost their lives in the great earthquake of April, 1905, the death-rate was 306·6, while in Dharmsala, which also suffered heavily, the rate was 90·02. The infant mortality, 235 per 1,000 births, was about normal.

In 1904 cholera was more rife than in 1904, but did not prevail in severe epidemic form, and was confined to a few localities. The deaths numbered 2,197, equal to 0·11 per 1,000. No less than 1,624 of the total deaths were in Lahore district. The highest urban death-rate was 13·78 per mille in Shujabad (Multan).

The mortality from small-pox was 4,723, or ·23 per 1,000, against 9,624 or ·48 per 1,000 in 1904. Ludhiana district was the chief sufferer with a death-rate of ·89 per 1,000, and Kangra, which is the best vaccinated district, had as usual the lowest rate.

From fevers the death-rate was 18·40 per 1,000 in 1905, or 6·65 below the quinquennial mean. Delhi district recorded the highest mortality, viz., 24·74 per 1,000. It is believed that many deaths really due to plague, respiratory diseases, &c., were classed as fevers. Quinine was as usual distributed gratuitously in many of the districts.

The death-rate from dysentery and diarrhœa was above that of 1904, though below normal. The highest rate was in Simla district (2·25). The urban death-rate was three times the normal.

Plague was not as widespread or as fatal in 1904. The deaths fell from 396,357, or 19·71 per 1,000, in 1904 to 334,897, or 16·65, in 1905. At first the disease was very virulent, but it declined later. In ten districts the death-rate was above 20 per 1,000. The large towns have suffered but little. Among districts Rohtak lost 52·6 per 1,000 of its population from the disease, Gurgaon, 40·9, Ludhiana 34·2, Amritsar,

34·0 and Lahore 29·7. The female plague death-rate is higher than the male. Infants and aged persons are markedly immune. The attitude of the people towards the disease is one of apathy, though evacuation is resorted to in many districts. Disinfection, inoculation, and rat destruction have been adopted as preventive measures.

North-West Frontier Province.

In the North-West Frontier Province the birth-rate rose to 35·4 per 1,000 in 1905 from 34·9 in 1904 (3·0 above the quinquennial mean), and the district rates ranged from 43·3 in Kohat to 31·7 in Hazara. The number of male births registered is much greater than that of females, A special enquiry appears to show that although registration is carelessly performed, the proportion of male to female births is really very high. The death-rate fell from 28·6 to 26·8 per 1,000. The year 1905 cannot be considered a healthy one, as the rate in the previous five years had averaged only 25·5. The infant mortality was 198 per 1,000.

In 1904 there was only one death from cholera, but in 1905 303 deaths were recorded owing to an epidemic in the Hazara district. From small-pox the death-rate fell from ·78 to ·29 per 1,000. The death-rate from fevers, 20·69 per 1,000, was lower than in 1904, but above the quinquennial mean, Peshawar district, as usual, being that most affected. The mortality from dysentery and diarrhœa was slightly lower. There was no indigenous plague in the province.

Burma.

The registration of vital statistics has hitherto been backward in Burma, but improvements are in progress. The weather conditions were generally unhealthy in 1905. In Lower Burma the birth-rate in 1905 was 34·34 per 1,000 against 32·71 in the preceding year. In Upper Burma the registration of births is confined to twelve towns, and the average birth-rate was 34·91 against 35·05 in 1904. In Lower Burma the death-rate rose from 22·36 in 1904 to 24·93, and in Upper Burma from 18·69 per 1,000 to 22·46. The high infant mortality rate is attributed to defective midwifery and insanitary conditions.

Cholera was prevalent during the year. The death-rate was ·63 per 1,000. The disease caused a death-rate of 4·11 per 1,000 in Mergui.

Small-pox was much more prevalent in Burma than in the previous year. The death-rate was 1·21 per 1,000 in Lower Burma as against ·24 in 1904. In Upper Burma, the increase was slight, the death-rate being ·18 as against ·17. In Rangoon the rate was as high as 2·98.

Fever as usual was the chief cause of death in the province, but the mortality was below normal. In Lower Burma the deaths were in the proportion of 8·97 per 1,000 against 9·91 in 1904, and in Upper Burma 6·76 against 7·05. In Akyab district the mortality rate was 23·14. With a view to the prevention of fever systematic measures were carried out generally for the destruction of mosquitoes, and more radical methods of prevention by drainage, &c., are contemplated. The people show little appreciation of quinine, the demand for which is small.

The death-rate from dysentery and diarrhœa in Lower Burma was 1·43 per 1,000 against 1·27 in 1904, and in Upper Burma the urban was ·60 and the rural ·43. The urban areas of Lower Burma suffer most. The rates for Rangoon, Bassein, and Thayetmyo were 5·09, 5·21, and 7·58 per 1,000 respectively.

There was no case of indigenous plague up till the end of 1904, but indigenous plague was discovered at Rangoon in February, 1905, and during the year there were 3,692 deaths in the province, including 2,468 in Rangoon, which had a death-rate of 9·79 per 1,000. Segregation of patients, surveillance of contacts, evacuation of infected villages, disinfection, inoculation, rat-killing, and provision of facilities for inoculation have been the principal anti-plague measures, and they met with considerable success.

Central Provinces and Berar.

The year was unhealthy, owing to delayed and heavy rainfall after a dry year, and influenza, malarial fevers, and bowel complaints were rife. The birth-rate in 1905 was 54·02 per 1,000 of population against 53·19 in 1904. In Yeotmal district the birth-rate was 61·24 per 1,000. All the districts registered comparatively high birth-rates. The death-rate was 37·21 per 1,000 as against 32·06 in 1904. The highest district death-rates were in Burhanpur (54·80) and Buldara (50·08). The infant death-rate was 301·29 among males and 270·94 among females per 1,000 born, an exceptionally high birth-rate, ignorance, neglect, insanitary conditions, and abnormal cold early in the year being responsible for the great mortality.

The number of deaths recorded from cholera declined, the total being 1,217, equal to a ratio of ·10 per 1,000, against ·24 in 1904. The infection is said to have been spread by pilgrims returning from Puri. There was no cholera in Berar.

The mortality from small-pox was greater than in 1904, the number of deaths rising from 2,026 or ·16 to 8,364 or ·70 per 1,000. The largest mortality occurred in the Buldana, Nagpur, and Saugor districts. The mortality among children was very high. The Sanitary Commissioner suspects that many deaths attributed to measles and chicken-pox were due to small-pox.

Fevers were more prevalent in every district, and the death-rate rose from 13·54 per 1,000 in 1904 to 17·43 in 1905. Malarial fevers were especially prevalent after the rains. Something was done during the year in the way of anti-malaria crusades by destroying mosquitoes, filling in pools, &c. The people do not take to quinine as a prophylactic.

The death-rate from dysentery and diarrhœa rose from 2·14 per 1,000 to 3·02, a higher rate than in any other province. The mortality in Berar was much greater than in the Central Provinces. The highest district death-rate was that of Akola in Berar, viz., 10·20 per mille.

Plague was much less prevalent (especially in the Central Provinces) during 1905, and the deaths fell from 42,866, or 3·43 per 1,000, to 12,706, or 1·07. Many deaths ascribed to fevers were probably due to plague. The attitude of the people with regard to plague measures continues to improve; they understand the value of evacuation and disinfection, but inoculation is still unpopular. Rat-killing has been energetically carried on.

Madras.

In the Madras Presidency during 1905 the rainfall was ill-distributed, and food prices rose. The birth-rate per 1,000, viz., 32·0, was the highest yet recorded, except in 1891. The rise was partly due to improved registration. The district rates ranged from 46 in Madras to 24·4 in Nellore. The total number of registered deaths was 786,123, or 21·4 per 1,000, against 22·5 in 1904. In the districts the death-rates ranged from 59·5 in Madras to 16·0 in North Arcot. There was diminished mortality from fever, cholera, and plague. Registration is still defective, though improving.

The number of deaths recorded as due to cholera was 16,888, giving a ratio of 0·5 per 1,000 of population, against 23,109, or 0·6 in 1904. The ratio for 1905 is the lowest since 1895. Owing to timely action taken to combat the disease its progress was checked in most of the municipal towns. The purification of polluted water with permanganate of potash yielded good results in the areas affected.

The death-rate from small-pox fell to 0·5 per 1,000 of population. This coincided with a lower rate in India generally. The mortality was highest in Madura and Bellary districts. In eight municipalities the death-rate exceeded 2·0 per mille. The death-rate of children under 10 was exceptionally high.

Deaths ascribed to fever fell to 265,044, or 7·2 per 1,000, the quinquennial average being 8·2. The mortality recorded under this head represents more than one-third of the total deaths. The highest district ratios were 15·0 per 1,000 in Ganjam and 15·8 in Vizagapatam. Preventive measures against malarial fever are receiving attention.

Dysentery and diarrhœa accounted for practically the same number of deaths as in 1904, the death-rate being 1·4. The heaviest district rate (11·2) was in Madras.

The number of deaths registered under plague fell from 20,125 in 1904 to 5,788 in 1905, representing a mortality of 0·2 per 1,000, which is not a high rate compared with the rates recorded by other provinces. Thirteen districts had no indigenous plague. The disease was most severe in Bellary, where the death-rate was 3·6, equal to 60 per cent. of the total mortality in Madras. As usual, the anti-plague measures adopted were employment of observation and preventive staffs, isolation of patients, segregation of contacts, disinfection of persons, effects, and houses, passporting and surveillance of persons from infected areas, and rat-killing.

Madras City.

In Madras City the birth-rate was 46 per 1,000, which was above the average. The death-rate was 59·5 per 1,000 (the highest in the Presidency) as against 44·2, the average of the previous 5 years. Deaths from all the principal diseases perceptibly increased. The total, 29,351 deaths, included 5,496 from fevers, 5,542 from dysentery and diarrhœa, 3,534 from cholera, which raged in a severe form from July to October, 321 from small-pox, and 22 from plague.

Bombay.

There was a most gratifying decline in the death-rate. The mortality from plague was much smaller than in 1904, while some of the other chief diseases were less fatal. As regards Sind mortality was heavier, owing to malarial fevers and pneumonia, ascribed to the exceptionally cold season.

The registered births numbered 611,173, or 37,421 less than in 1904, and the birth-rate fell from 35·09 to 33·07 per 1,000, which, however, was above the quinquennial mean. Among the districts, Khandesh registered the highest rate, 46·63, followed by Broach, 45·09. The lowest rate was recorded in the Sind district of Thar and Parkar (17·88). Registration of births is unsatisfactory, especially in Sind.

The deaths numbered 588,394, or 31·84 per 1,000, against 764,914, or 41·39 in 1904. The highest district death-rates were 62·33 in Bombay City, and 41·13 in Ahmedabad. In Ahmedabad City the death-rate was 63·43. Infant mortality, 220 per 1,000, was unduly high.

There was comparatively little cholera in the Presidency during 1905, and the death-rate was only 0·29 per mille as against 0·71 in 1904. The only districts much affected were Bijapur, Dharwar, and Belgaum, in which the respective death-rates were 2·02, 1·91, and 1·60 per mille.

From small-pox there were 16,985 deaths, a ratio of 0·92 per 1,000, as against 0·23 in 1904. The mortality was the highest recorded for 27 years. The Bombay and Khandesh districts combined accounted for much more than half the total deaths. About 36 per cent. of the deaths occurred amongst children under one year of age.

The death-rate from fever was only 13·28 per 1,000, or 4·12 below the quinquennial mean. Of the districts Ahmedabad again recorded the highest fever mortality (28·38). Distribution of quinine was adopted.

The deaths ascribed to dysentery and diarrhœa showed a reduction. The death-rate was 3·00 in 1905, as against a quinquennial mean of 4·87.

The deaths from plague were 71,363, or 3·86 per 1,000, or less than one-third of those in 1904, when the death-rate was 12·12 per 1,000. The abatement was shared by nearly all districts, and was greatest in those which have suffered most in the past. The highest district rate (11·68 per 1,000) was in Satara. Karachi town had a death-rate of 24·86. The use of prophylactic serum was extended, and voluntary evacuation of infected localities continued. Among 27,242 persons inoculated plague occurred in only five cases. Although the incidence of the disease was much lighter, its virulence did not decrease, the average case-mortality being 75 per cent.

City and Port of Bombay.

In Bombay City the registered birth-rate was 24·66 per 1,000 in 1905, as against 25·20 in 1904. There was an increase in mortality, the death-rate being 62·3 in 1905 as against 55·0 in 1904. The deaths from plague were 14,171 in 1905 (18·63 per 1,000) as against 13,538 in 1904, and 20,788 in 1903. Cholera caused only 25 deaths. Bombay had the lowest death-rate from fever in the Presidency, 3·41 per 1,000, and the highest from respiratory diseases (12·19).

In Bombay Port 838,953 persons (including crews) were inspected in 1905, and the clothing and bedding of 99,378 of these were disinfected. There were 27 cases of plague, 1 of cholera, 386 of small-pox, and 21 of jigger.

Red Sea Pilgrim Traffic.

Red Sea Pilgrim Traffic.—In September, 1904, the period of detention in observation camps near the port of embarkation was reduced from ten to five days, after which, on passing a satisfactory medical inspection and being disinfected, pilgrims were allowed to proceed. Further changes in the regulations became operative in the season 1906-7. The Haj in 1904-5 was open to any resident in India. All pilgrims were required to embark at Bombay. The year's pilgrimage was smaller than the preceding one; only 12,449 pilgrims sailed from Bombay. Their health was good.

IV.—JAILS.

Sickness and mortality in 1904.

Sickness and Mortality in 1905.—The vital statistics of prisoners in India over a series of years show a general fall in the death-rate, attributed to improvement in the sanitary condition of the jails, though there have been violent fluctuations, ascribed to varying climatic influences. Much is being done for the improvement of jail sanitation and a still further reduction in mortality may be hoped for. The conditions in 1905 were unfavourable to the health of the prison populations, but, in spite of adverse conditions, the statistics show no specially noteworthy ill effects on the health of the prisoners. The mean daily population of the jails in India and Burma (excluding the Andamans) was 91,917, and the admission-rate 647 per 1,000, the constantly-sick-rate 28 per 1,000, and the death-rate 19·23 per 1,000. The admission-rate was the lowest on record. There was an increased death-rate in all provinces except Madras, Bombay, the Punjab, and Burma.

The following statement shows the sickness and mortality among all classes of prisoners in the jails of the various provinces for 1905 as compared with 1904:—

Provinces.	1904.			1905.		
	Ratio per 1,000 of Average Strength.			Ratio per 1,000 of Average Strength.		
	Admissions.	Constantly Sick.	Deaths.	Admissions.	Constantly Sick.	Deaths.
Bengal	883	35	19·6	954	39	24·9
United Provinces of Agra and Oudh.	612	28	14·6	569	27	17·3
Punjab	907	31	19·8	708	26	16·3
North-West Frontier Province...	1,102	32	14·6	960	34	19·8
Burma	387	20	18·6	320	17	17·0
Central Provinces and Berar ...	586	20	12·6	630	21	15·8
Eastern Bengal and Assam ...	979	37	22·4	1,081	46	33·0
Madras	439	20	16·5	469	19	15·9
Bombay	600	25	19·2	603	27	17·4
India (excluding the Andamans)	676	28	17·6	647	28	19·2

Chief Diseases.—The chief causes of sickness were intermittent fever (admission rate 182 per 1,000), dysentery (82), abscesses, ulcers, and boils (71), and diarrhœa (39), while the chief causes of death were tubercle of the lungs (3·2 per 1,000), dysentery (3·0), and pneumonia (2·3). There was an increase in the incidence of cholera and plague. The death-rate (0·91 per 1,000) from intermittent fever was somewhat higher. In remittent fever there has been a great reduction in the last five years. Bowel complaints, formerly the scourges of Indian jails, are now much less prevalent and deadly, though as causes of mortality they still occupy a foremost place. As regards dysentery, now fully recognised as infectious, the admission-rate has fallen slightly but irregularly in the last 10 years, while the fall in the death-rate has been rapid in recent years, mainly owing to successful treatment. It is, however, still one of the chief causes of mortality, and a special enquiry has been undertaken with regard to its causation, prophylaxis and treatment. Both admission and death-rates for diarrhœa were the lowest on record. Bombay and Bengal had the highest death-rates. The mortality from pneumonia, which is one of the deadliest of jail diseases, tends very gradually to decline, as the result of more efficient ventilation and the treatment of the disease as infectious, and, in spite of the wide diffusion of influenza, the admission and death-rates from pneumonia in 1905 were the lowest on record. In 1904 tubercle of the lungs, though it had declined since 1902, became for the first time a leading cause of mortality. In 1905 there was a considerable increase in the prevalence and fatality of this disease, the jails of Bengal, Eastern Bengal and Assam, and Madras being most affected. There were 40 deaths from cholera as against 31 in 1904, while deaths from small-pox were only four. Although plague was so widespread and fatal during the year there were only 46 deaths from it in the jails owing to the precautions taken. Enteric fever accounted for 15 deaths, and cerebro-spinal fever for only nine deaths.

Bengal. Owing to the unhealthiness of the year the sickness and mortality of the jail population of Bengal were greater than in 1904. The more complete separation of different classes of prisoners has added to the over-crowded condition of some of the prisons. The death-rate among all classes of prisoners (25·3 per 1,000) was much higher than in 1904, when it was 19·5. The admission-rate was 954 per 1,000. The lowest death-rate was in Cuttack Jail (9·4), and the highest in Burdwan (43·3), Purulia (46·6), Chaibassa (44·1), and Midnapore (45·0). The Presidency Jail is about to be demolished. Defects in construction in Midnapore and Purulia Jails are being remedied. Under a new Superintendent the death-rate in Balasore Jail, 79·7 per 1,000 in 1904, has fallen to 22·6 in 1905. The chief causes of sickness were intermittent fever (30·5 per cent. of all admissions) and dysentery and diarrhœa (30·1), and the principal causes of death (26·3 per cent. of all deaths) tubercle of the lungs (16·1), intermittent fever (11·0), and pneumonia (8·5). There was in 1905 a slight decrease in the admissions from intermittent fever. The cases numbered 4,120, while deaths were 39. There were 2,783 cases of dysentery and 93 deaths. The disease is most common in Jessore and Midnapore. Tubercle of the lungs is widespread and shows an increase. The Alipore, Midnapore, Hazaribagh, and Presidency Jails were those most affected. It is proposed to segregate at Berhampore tubercle cases from all jails. A decline in cases of pneumonia is ascribed to better ventilation of sleeping wards. In spite of the wide prevalence of plague the disease attacked only five jails, which recorded 12 cases and 8 deaths.

Eastern Bengal and Assam. The year was unhealthy and among the prisoners in Eastern Bengal and Assam the admission, constantly-sick, and death-rates were all higher than in recent years. The chief causes of sickness were dysentery and ague, and of death, dysentery, tubercle of the lungs, and beri-beri. Among convicts there were 1,830 cases and 47 deaths from dysentery, which was especially severe at Gauhati. The mortality from tubercle was greater than in 1904. There were 11 cases of cholera and 10 deaths. Beri-beri was epidemic at Sylhet and caused 21 deaths. The rate of mortality was very high at Barisal (62·87), Gauhati (58·25), Dibrugarh (57·69), and Sylhet (54·79). Improvements are being effected at Barisal in accommodation and water supply.

United Provinces of Agra and Oudh. The health of the prisoners in the United Provinces of Agra and Oudh was fairly good during the year 1905, although climatic conditions were unfavourable. Influenza was very prevalent. Among all classes of prisoners the admission-rate per 1,000 of average strength was 569 against 612 in 1904, but the death-rate rose to 17·3 from 14·6 per 1,000. In seven of the larger jails there were death-rates of over 30 per 1,000. The higher death-rate was largely due to diseases contracted before admission to jail, but in the jails there were also more plague deaths. The precautions against dysentery taken in Gorakhpur Jail have succeeded. At Benares Jail, where general conditions are satisfactory, the death-rate rose from 10·4 to 33·6 per 1,000, ascribed largely to deaths among old men consequent on the cold winter and spring. The Mirzapur District Jail recorded a rate of only 9·6 per 1,000. The chief cause of sickness was ague (32 per cent. of all admissions). Among the chief causes of death were dysentery (17·3 per cent. of all deaths), tubercle of the lungs (15·4), and dysentery (11·2). There has been a great reduction in the mortality from dysentery in recent years owing to the excellent sanitary conditions under which the prisoners live, to segregation of cases, to disinfection, and to the care which is given to the purity of the water and food supplies. In the majority of the jails there is accommodation for isolating cases of tubercle of the lungs. Pneumonia caused more admissions than in 1904, and 70 as against 59 deaths. In spite of its widespread prevalence in the province, plague accounted for only 26 cases and 19 deaths.

Punjab. The health of the prisoners in the Punjab during 1905 was wonderfully good. The admission-rate declined from 907 to 708 per 1,000, and the death-rate from 19·76 to 16·33. Improvements in the sanitation, accommodation, and ventilation of jails were in active progress. The highest death-rate last year was in the district jail at Lahore, but in 1905 it fell to 10·85 from 36·32 per 1,000. The admission-rate for malaria fell from 342 in 1904 to 259 in 1905, the decline being ascribed chiefly to the maintenance of quinine prophylaxis in the autumn months and treatment of prisoners when admitted to jail. Dysentery, which caused only 6 deaths altogether in 3 jails was completely absent from 25 jails, and its incidence tends to decrease, owing to improved sanitary methods.

Tubercle of the lungs showed an increase from 40 to 50 deaths, while pneumonia caused a mortality of only 28 as against 60 in 1904. These diseases combined were responsible for 44 per cent. of the mortality among convicts. Prevention by prompt detection, isolation, disinfection, &c., is the remedy relied on. Cholera and plague appeared in 3 jails in 1905, but as prompt precautions were taken, only 8 deaths occurred from both causes.

North-West Frontier Province.

The general health of the prisoners in the North-West Frontier Province during 1905 was fairly satisfactory. There was intermittent overcrowding, especially in Kohat and Abbottabad Jails. The death-rate rose from 14·7 to 19·8, which was 7 below that of the free population. Malaria as usual was responsible for most admissions, viz., 380 per 1,000, and it was specially prevalent at Dera Ismail Khan and Kohat. Epidemic influenza caused several deaths in Peshawar Jail. This largely explains the high admission-rate in that jail (42·0 per 1,000). Dysentery was the chief cause of mortality.

Burma.

Among the prison population of Burma the admission and constantly-sick rates were the lowest on record, while the death-rate, which fell from 18·63 per 1,000 in 1904 to 17·01 in 1905, was the third lowest on record. Owing to various improvements the exceptional mortality in Mandalay Jail has been reduced, and the death-rate fell from 79·3 in 1904 to 17·3 per 1,000 in 1905. The central jail at Thayetmyo had the high death-rate of 37·66, dysentery and diarrhœa being very prevalent during the rains and cold weather. The most healthy central jail was the Bassein Central Jail, which recorded a death-rate of 11·92. The chief causes of sickness were abscesses and ague, while the chief causes of death were tubercle of the lungs and dysentery. From dysentery there were 31 deaths as against 32 in 1904. The admissions for tubercle rose from 75 to 88, and the deaths from 36 to 51. The isolation of these cases and their treatment in the open air received the special attention of the medical officers as heretofore. Admissions and deaths from pneumonia, viz., 38 and 12, respectively, were higher than in 1904, when the numbers were 26 and 8.

Central Provinces and Berar.

The improvement in the health of the prisoners in the Central Provinces and Berar Jails noticed in 1903 and 1904 was not maintained during 1905. There was more sickness and the death-rate rose from 12·57 to 15·79. Malarial fevers were as usual the chief cause of sickness and accounted for 30·27 per cent. of the admissions. Tubercle of the lungs, pneumonia, and other respiratory diseases and dysentery were the chief causes of death. The number of admissions (134) and deaths (5) from dysentery was the same as in 1904. From tubercular diseases the mortality was less than in 1904. Although plague was epidemic in so many towns, only one death occurred in the prisons, owing to careful segregation of all admissions from infected localities.

Madras.

The general standard of health was well maintained throughout the year 1905 among the prisoners in the Madras Presidency. The death-rate fell from 16·5 per 1,000 in 1904 to 15·9 in 1905 and was the lowest on record during the last decade. The highest death-rates were in the central jails at Rajahmundry and Cannanore. In the former cholera was epidemic and accounted for most of the deaths. The chief causes of sickness were ague (18·25 per cent. of all admissions) and dysentery (13·63 per cent.), and the chief causes of death were dysentery (19·3 per cent. of all deaths), tubercle of the lungs (14·9 per cent.), pneumonia (9·3 per cent.), and cholera (8·7 per cent.). A special receiving hospital for tubercular diseases has been established at Trichinopoly, and another is in progress for Bellary Central Jail.

Bombay.

There was rather more sickness among the prisoners in the Bombay Presidency during the year 1905, but the death-rate was only 17·45 per 1,000 (the lowest on record) against 19·22 in 1904. Overcrowding occurred in only four jails, and was sometimes relieved by transfers, and by the use of temporary sheds, &c. In the Common Prison, which is structurally defective and was overcrowded, the death-rate reached 55·6 per 1,000. The Thana Jail death-rate fell from 23·39 per 1,000 to 14·83, and although tubercle is still the chief cause of mortality its prevalence has diminished as a result of improvements in treatment and accommodation. A tubercle ward has been established there. The principal cause of sickness in the jails of the Presidency was ague (22·3 per cent. of all admissions) and the chief causes of death pneumonia (17·5 per cent. of all deaths) and tubercle of the lungs (13·1 per cent.).

Sickness and mortality from pneumonia declined, and there was no virulent outbreak in the Sind Gang, improvements in which, it is hoped, will render the disease no longer formidable. There was a marked decline in malarial fever. There were only 16 cases of plague and 10 deaths.

Andamans.

In 1905 the rainfall in the Andamans was below normal. The provision of permanent barracks has not kept pace with the steady increase in the convict population, but many bamboo and thatch barracks were constructed and occupied, while additional wards were provided for lunatics and for phthisical and other hospital patients. No change has been made in the water-supply and conservancy arrangements. An improvement has been effected in the diet and in the milk supply. In 1905 the average daily strength was 14,348, the admission-rate 1,898, the constantly-sick-rate 68, and the death-rate 38·96 per 1,000. The sick-rate and death-rate were higher than in 1904 owing to dysentery and cellulitis. Malarial fevers, the great scourge of the Settlement, accounted for 65 per cent. of the total admissions to hospital, dysentery and diarrhœa for over 11 per cent. Of the total mortality, 31 per cent. was due to respiratory diseases, including phthisis, and 35 per cent. to dysentery and diarrhœa. The lower admission and death-rates from tubercle of the lungs are ascribed to the vigorous measures adopted against the disease.

V.—VACCINATION.

General results.

Vaccinations are chiefly performed by a special department, which in 1905-6 comprised 15 European and 488 native supervising officers and 6,777 vaccinators, but a small proportion is performed by the staff at hospitals and dispensaries. During 1905-6 9,277,896 persons were vaccinated in India, being an increase of 333,147 on 1904-5. The increase was spread over all the provinces except Madras and Bombay, the rise being notable in Bengal. The number of primary operations was 8,586,770, and the percentage of success 97·20. According to age, 4,161,967 children under one year of age, and 3,474,929 children between one and six years were successfully vaccinated. The proportion of the population protected against small-pox by the year's operations ranged from 55·45 per 1,000 in Coorg to 27·35 in Bombay Presidency, the mean proportion of the total population successfully vaccinated being 36·39 per 1,000 as against 34·79 in 1904-5. The cost of the special department was £85,510.

The following statement shows the results of vaccinations in 1905-6:—

Province.	Population among whom Vaccination was carried on.	Number of Persons vaccinated (including re-vaccinations) by special department and dispensary staff.	Ratio of successful Vaccinations per 1,000 of Population.	Number of Children successfully vaccinated.		Percentage of Annual estimated Births at 40 per 1,000 of Population successfully vaccinated.
				Under One Year of Age.	Between One and Six Years of Age.	
Bengal	51,656,383	2,041,230	37·94	809,606	973,461	39·18
Eastern Bengal and Assam ...	30,788,134	1,429,026	44·86	414,109	804,891	33·62
United Provinces of Agra and Oudh.	47,960,667	1,695,416	33·79	950,885	532,398	49·57
Punjab	20,293,834	748,739	34·31	507,638	103,636	62·54
North-West Frontier Province	2,092,713	100,866	44·11	49,320	23,224	58·92
Burma	10,477,508	488,927	37·84	89,131	208,026	21·27
Central Provinces and Berar...	13,621,559	626,138	44·83	418,160	109,918	76·75
Madras Presidency	38,408,531	1,464,990	33·75	462,317	611,548	30·09
Bombay Presidency	21,438,769	656,338	27·35	448,654	99,951	52·32
Coorg	180,607	11,291	55·45	844	5,150	11·68
Ajmer-Merwara	476,912	14,935	30·63	11,303	2,726	59·25
TOTAL	237,395,617	9,277,896	36·39	4,161,967	3,474,929	43·83

Bengal.

Vaccination in the reconstituted province of Bengal continues to make good progress. The results of vaccination work during 1905-6 show a rise in the proportion of successful vaccinations to 37·94 per 1,000. The increased work is mainly ascribed to more careful supervision, rewards to vaccinators, less prevalence of plague, and greater prevalence of small-pox. A severe outbreak of small-pox increased the number of re-vaccinations by over 50,000 in Calcutta. Much improvement is expected from the new scheme for the better training of vaccinators and inspectors, and from the wider use of prepared lymph. Out of the 33 districts there was an increase of vaccinations in 23 and a decrease in 10. Of the total primary vaccinations 151,080 were performed with calf lymph, 400,847 with lanoline lymph, and 1,352,698 by the arm to arm process, the ratio per cent. of success under each of these methods being 98·92, 96·57, and 99·21 respectively. Infant vaccination is making progress, especially in Calcutta.

Owing to efforts made to cope with the small-pox outbreak the Calcutta vaccination returns showed a large increase, the total number of persons vaccinated (85,287) being 57,235 more than the number in the previous year. The Department has been remodelled. An Animal Vaccine Depôt has been established.

Eastern Bengal and Assam.

There was an increase of vaccination work in this reconstituted province, especially in the Chittagong, Faridpur, and Noakhali districts. The percentage of successful primary operations was 98·28. Re-vaccinations were relatively few. Vaccination of children under one year of age increased, 33·62 per cent. of the estimated number available being protected. The quality of the lymph produced at the Animal Vaccine Depôt at Shillong was uniformly excellent. The use of human lymph is gradually ceasing, though in 1905-6 51 per cent. of the operations were from arm to arm, while 29 per cent. were from manufactured vaccine.

United Provinces of Agra and Oudh.

In spite of the great prevalence of plague and cholera in this province during 1905-6 the number of vaccinations increased by 23,656. There was an increase in primary vaccinations, and a decline in re-vaccinations. The percentage of successful primary cases in which the results were known was a little higher than last year, viz., 97·93 against 97·62. Of the estimated number of children 49·57 were successfully vaccinated. Bovine lymph depôts were maintained at Lucknow and Patwa Dangar (Naini Tal). The latter is a new depôt, well equipped, and its utility has already been amply proved.

Punjab.

Though seriously interfered with by plague, the number of vaccinations in the Punjab increased by 28,968 cases, or 4 per cent. There is strong prejudice, especially in the case of females, against re-vaccinations, in which, however, the percentage of success increased to 83·78, though the number of operations was smaller by 27,323. Of the estimated number of infants under one year of age, 62·54 per cent. were vaccinated. Chloroformed glycerinated lymph of good quality is now prepared at the Central Vaccine Institute, Lahore. Of 100,768 primary vaccinations performed with it in 1905-6, no fewer than 99·94 per cent. were successful.

North-West Frontier Province.

In the North-West Frontier Province the total number of operations rose by 23,824. Of these 87,771 were primary cases with a percentage of success of 98·56. Calf lymph from the Lahore Depôt was used in the great majority of operations. Out of the ten municipal towns in the province, the Vaccination Act is now in force in all but two, viz., Peshawar and Takki. Though the local administration recognises the advisability of extending the Act to other towns, and especially to Peshawar, it is considered that the initiative should be taken by the local bodies.

Burma.

The total number of vaccinations performed in Burma rose in 1905-6 by 75,924. The increase was especially large in re-vaccinations, which also showed improved results. The increase in vaccination was notably great in Rangoon. In primary vaccinations the percentage of success rose from 84·67 to 90·80. Vaccination is wholly with bovine lymph. The whole supply for Burma (excepting Rangoon, where there is a municipal depôt) comes from the central depôt at Meiktila, where useful experiments for improving the preparation of vaccine were carried out. There is a reluctance to allow children under one year to be vaccinated. The newly-sanctioned vaccination staff is to undergo training at the Meiktila Depôt.

Central Provinces and Berar.

There was an increase in primary vaccinations and especially in re-vaccinations during 1905-6. The percentage of success in primary operations was 97·26 and in re-vaccinations 62·83. In recent years plague has hindered vaccination work, but progress has been steady. Of the estimated infant population, 76·75 per cent. were successfully vaccinated. Glycerinated calf lymph is taking the place of fresh calf lymph and human vaccine lymph, and four-fifths of all operations were performed with it, the percentage of success being 93·14.

Madras.

The total number of vaccinations performed in the Madras Presidency during 1905-6 showed a decrease of 49,244 in primary operations, and an increase of 30,965 (or 40 per cent.) in re-vaccinations, as compared with 1904-5. The decrease is ascribed to the short supply of vaccine paste and absence of vaccinators. The shortage in the supply of vaccine paste was due to the bad season in Chingleput, and the poor state of nutrition of the calves. The percentage of success in primary operations rose to 92·67, against 87·38 in 1904-5. A satisfactory feature of the year's work is an increase in the number of children under one year of age successfully vaccinated, but the total number represented only 30 per cent. of the estimated number available. An inspector visited the more backward districts to train vaccinators in the use of the paste. Lanoline lymph, manufactured at the King Institute, Madras, was generally used, and the results showed a marked improvement over those for 1904-5, the success rate being 92·3 per cent.

Bombay.

The steady increase in vaccination work in recent years was not continued in 1905-6, a fall occurring in the re-vaccinations. Out of the total primary vaccinations 97·56 per cent. were successful. During the year 52·32 per cent. of the available infants were successfully vaccinated. After trials at the Vaccine Depôt for the preparation of preserved lymph at Belgaum it has been decided to adopt chloroformed glycerine lymph, the use of which is being extended. In re-vaccination the percentages were 80·28 males and 19·72 females, the small proportion of the latter illustrating the difficulties in this class of work.

VI.—MEDICAL INSTITUTIONS.

Civil Hospitals and Dispensaries.

Institutions and Patients.—The institutions included under this head are those classed as (1) State-Public; (2) Local Fund; and (3) Private Aided. The great bulk of their income is derived from Government, local, and municipal funds, and their total expenditure in 1905 was £607,430. The dispensaries not included comprise (1) State-Special (Police, Forests and Surveys, Canals, &c.); (2) Private Non-aided; and (3) Railway, which together numbered 1,446 and provided treatment for about 128,600 indoor and 6,107,000 outdoor patients.

The principal diseases treated in 1905 were malarial fevers, dyspepsia and other disorders of the digestive system, ulcers and other skin complaints, diseases of the eye and ear, diseases of the respiratory system, and worms. The surgical operations numbered over a million.

The following comparative statement shows the number of hospitals and dispensaries under official control in the several provinces of India during 1905 and the previous year, and the number of patients under treatment:—

Provinces, &c.		Number of Institutions.	Number of In-door Patients treated.	Number of Out-door Patients treated.	Total Number of Patients.
Bengal	1905	305*	33,384	2,328,545	2,361,929
	1904	494	44,228	3,965,347	4,009,575
Calcutta and Howrah	1905	15	25,168	263,267	288,435
	1904	15	24,370	263,020	287,390
Eastern Bengal and Assam	1905	331*	21,714	2,881,907	2,903,621
	1904	120	6,794	946,895	953,689
United Provinces of Agra and Oudh	1905	343	52,432	3,633,557	3,685,989
	1904	344	50,855	3,584,200	3,635,155
Punjab	1905	264	57,091	3,199,250	3,256,341
	1904	257	55,017	3,250,607	3,305,624
North-West Frontier Province ...	1905	37	8,129	528,061	536,190
	1904	36	8,321	569,614	577,935
Burma	1905	141	55,610	967,245	1,022,855
	1904	140	50,593	972,790	1,023,383
Central Provinces and Berar	1905	149	12,497	1,611,525	1,624,022
	1904	150	12,147	1,550,889	1,563,036
Coorg	1905	7	1,005	43,189	44,194
	1904	5	792	41,849	42,641
Madras	1905	491	66,930	5,170,575	5,237,505
	1904	493	60,449	5,150,892	5,211,341
Bombay	1905	301	51,068	2,125,324	2,176,392
	1904	296	48,141	2,085,863	2,134,004
TOTAL	1905	2,384	385,028	22,752,445	23,137,473
	1904	2,350	361,707	22,382,066	22,743,773

* Provinces reconstituted.

Bengal.

Owing to the reconstitution of the province the figures for 1905 and 1904 are not comparable. In the area now included under Bengal there was an increase in the number of patients, ascribed partly to the unhealthiness of the year, partly to the increased confidence of the people in the medical charities, which, in the last few years, have much improved in general management and efficiency. A satisfactory feature in the returns is the increased popularity of the dispensaries among female patients and children. The patients suffering from malarial fever numbered 24·5 per cent. of the total. Cholera and plague were much more prevalent than in 1904. The death-rate amongst the in-patients was 10·8 per cent. The number of operations performed was 152,227. Among the more important operations there were 2,239 cases of cataract. In several districts the work of the dispensaries has been supplemented by measures for supplying medical relief to outlying markets.

Calcutta and Howrah.

Much is still being done to modernise the chief general hospitals in Calcutta. In 1905 at the 15 institutions there was an increase in the number of indoor patients, ascribed to the unhealthiness of the year, small-pox, cholera, plague, and diarrhœa being prevalent. The number of women and children is increasing. The total number of operations performed during the year was 30,110, against 30,353 in 1904.

Eastern Bengal and Assam.

Owing to the reconstitution of the province the figures for 1904 and 1905 are not comparable. The number of in-patients was 21,714, and of these 2,001 died, giving a death-rate of 9·2 per cent. against 8·1 in 1904. Of the various diseases for which the patients were treated the largest numbers were skin diseases, worms, and malarial fevers. Cholera and small-pox cases greatly increased. The total number of operations was 73,989, of which 113 were fatal. Of the operations, comparatively few were important.

United Provinces of Agra and Oudh.

The hospitals maintained their popularity. The year was a heavy one, owing to epidemics of plague and cholera, and the strain on the medical staff was severe. Several hospitals have been improved. Special attention has been paid to the surgical equipment and to operating rooms. More Hospital Assistants are needed. The Agra Medical School has been enlarged. A medical college is being erected. There was a large increase in the number of patients during 1905. Among the in-patients the death-rate was only 4·54 per cent. There was a great decrease in cases of malarial fevers, but an increase in cases of skin disease and respiratory disease. The number of surgical operations increased to 184,346, including a large number of simple operations for evacuation of abscesses and teeth extractions, and of these 161,713 resulted in cure, while 428 were fatal. The number of visits to patients in their homes by Lady Doctors and Hospital Assistants was 4,676.

Punjab.

There were 264 hospitals and dispensaries at work in the Punjab at the close of 1905. The attendance of in-patients exhibits an increase on that of the previous year. A satisfactory feature was the larger number of women and children. Of the 57,091 in-patients, 3·17 per cent. died, against a mortality of 3·42 in 1904, a satisfactory decline. The healthiness of the year, apart from plague, diminished the number of out-patients. The severe plague epidemic did not affect the popularity of the indoor dispensaries. There was a decline in malarial fever, spleen, and eye cases, and a marked rise in diseases of the skin and respiratory system. In the number of surgical operations performed (180,408), there was an increase of 7,965, and the total was the largest on record. Of the total operations only 0·15 per cent. were fatal. The percentage of deaths has declined. There were 7,683 operations for cataract, and of these 6,403 were successful.

North-West Frontier Province.

The slight decrease in the number of patients treated appears to have been due not to any decline in the popularity of the dispensaries in the North-West Frontier Province, but to the healthier conditions prevailing during the year 1905. Of the 8,129 in-patients, 6,000 were cured and 281 died. The chief diseases treated were malarial fever, diseases of the eye, and ulcers. There was a large increase in patients suffering from tubercular and respiratory diseases. The total number of operations performed was 23,982, a small increase on 1904.

Burma.

Of the in-patients 6 per cent. died, as compared with a mortality of 5 per cent. in the previous year. As usual malarial fevers headed the list of diseases for which patients sought treatment, next in order being worms, ulcers, diseases of the eye, skin diseases, and diseases of the digestive system. There were more admissions for cholera and small-pox. The number of surgical operations continued to increase, and in 1905 aggregated 24,536. Amongst the patients operated on only 0·36 per cent. died. Important operations were few. The attendance of women and children at hospitals in Burma is comparatively small, but the provision of better arrangements for women is being attended to. Medical work in Burma is hampered by the difficulty of recruiting suitable men as Assistant Surgeons and Hospital Assistants. The equipment and appliances of the institutions are being improved.

Central Provinces and Berar.

During the year 1905 there were 149 hospitals and dispensaries at work in the Central Provinces and Berar, and 1,624,022 patients were under treatment. Both in- and out-patients increased, and but for plague, this increase might have been greater. The number of in-patients was 12,497, of whom 6·4 per cent. died. As regards the different diseases, ulcers and other skin diseases, malarial fever, diseases of the digestive system, diseases of the eye, and respiratory diseases were most numerous. The surgical operations performed during the year numbered 40,942. The female attendance has slightly increased, but is smaller than might be expected.

Madras.

In the hospitals and dispensaries of the Madras Presidency more patients are treated than in those of any other province. About 15 per cent. of the total population were attended to in 1905. Of the 66,930 in-patients, who largely increased,

6·75 per cent. died, against a death-rate of 5·9 per cent. in 1904. Among the diseases treated the most important were ulcers and other skin diseases, diseases of the digestive system, malarial fevers (which showed a large decline), worms, diseases of the eye and ear, respiratory diseases, and rheumatic affections. There were increases in dysentery, diarrhœa, and tubercular diseases. During the year 187,436 operations were performed. The results show that only 0·25 per cent. died. The surgical equipment and operation rooms have been improved. The popularity of medical institutions appears to be growing.

Bombay.

The in-patients numbered 51,068, and of these 32,386 were cured and 5,915, or 11·6 per cent. died. Among patients the most common diseases were, as usual, malarial fever, diseases of the skin and the eye, worms, and respiratory affections. The surgical operations performed during the year numbered 82,113. In all the large hospitals in Bombay City, and in some of those in the mofussil, buildings, furniture, fixtures, and instruments have been improved. The employment of trained nurses is being slowly extended.

Lunatic Asylums.

The following table shows the strength of the asylum population in 1905 and the statistics of sickness and mortality:—

Administrations.	Admitted and Re-admitted during year.	Total Asylum Population.			Discharged Cured.	Died.	Daily Average Strength.	Daily Average Sick.	No. of Criminal Lunatics.
		Male.	Female.	Total.					
Bengal	219	857	203	1,060	83	77	837	70	513
Eastern Bengal and Assam...	105	439	91	530	50	32	429	31	264
United Provinces of Agra and Oudh.	503	1,296	390	1,686	131	105	1,199	93	450
Punjab	184	612	148	760	70	56	597	42	142
Burma	150	522	73	595	36	33	454	32	269
Central Provinces	68	268	90	358	34	29	293	8	91
Madras	185	584	187	771	65	86	587	63	164
Bombay	367	951	252	1,203	125	52	868	22	162
Total, 1905 ...	1,781	5,529	1,434	6,963	594	470	5,264	361	2,055

The total number admitted into asylums in 1905 was 1,667, the average for the five years to 1905 being 1,401. The total asylum population of the year was 6,963. The lunatics in asylums represent only a small proportion of the insane population.

Owing to the difficulty of ascertaining the history of patients the causes of insanity are in most cases unknown. The commonest forms of insanity are mania and melancholia.

Bengal.

The Berhampur asylum has been enlarged and the Dullunda asylum closed. The Cuttack asylum is also to be closed. A new central asylum is to be erected at Ranchi, and placed under an expert alienist. The figures for 1905 in the above table for Bengal relate to four asylums, viz., Bhowanipur, for Europeans, and Cuttack, Patna, and Berhampur, for natives. There has been an increase in the asylum population in recent years. Mania and melancholia are the chief causes of admission. In a large percentage of cases the causes of insanity are not ascertained. The death-rate is not high. Improvements in the management has taken place in the direction of the "non-restraint" system.

Eastern Bengal and Assam.

In the reconstituted province of Eastern Bengal and Assam these are two asylums (Dacca and Tezpur). Both were reported overcrowded, especially Tezpur. The death-rate was high at the Dacca asylum, mainly owing to tubercle of the lung, but the rate for the two asylums was not above the general average for India.

United Provinces of Agra and Oudh.

There are four lunatic asylums (Agra, Bareilly, Benares, and Lucknow) in the United Provinces of Agra and Oudh. The general health of the patients was good, except at Benares, where the health of the city was unsatisfactory. The death-rate was low. Mania was the chief cause of admissions, followed by dementia and melancholia.

Punjab. The population of the asylum at Lahore increased. Owing to the increase of patients the asylum has become overcrowded, and enlarged accommodation is being provided. A special building has been opened for females, and a new and better system of nursing introduced for women patients. Insanity is less common among women than among men, but the percentage of recovery is lower among women.

Burma. The Rangoon Asylum, which is the only one in Burma, has accommodation for 427 insanes. There was considerable overcrowding, but plans and estimates are under discussion for the erection of a new and larger asylum near Mandalay. The health of the asylum was unsatisfactory during the year, but the death-rate showed a marked improvement. The staff has been increased and various sanitary improvements have been effected.

Central Provinces. There are two asylums in the Central Provinces (Nagpur and Jubbulpur). There is overcrowding at Jubbulpur. It is proposed to remove all female lunatics to Nagpur. The general health of the asylum population improved with a substitution of wheat for millet as the staple diet at Nagpur, but the mortality-rate has remained high.

Madras. In the three asylums (Madras, Vizagapatam, and Calicut) of this Presidency the accommodation was ample, and there was no overcrowding in any of them during the year. There was more sickness among the patients than in 1905, especially from cholera and diarrhœa, and the death-rate was also higher.

Bombay. There are at present seven asylums in the Bombay Presidency. A new central asylum is to be erected at Yeravda, near Poona. The health of the inmates was on the whole satisfactory. Mania and melancholia are the chief causes of admission, but the history of many cases is unknown. Soldiers furnish the largest number of admissions. The death-rate tends to decline.

Medical Schools.

Bengal. The Medical College, Calcutta, and three of the medical schools are maintained by Government, the rest are unaided. The Government medical schools train pupils as Civil Hospital Assistants, and the unaided schools follow their own standards for private practice.

The total strength of the College at the end of the session 1905-6 was 443 (including 17 women). In the Preliminary Scientific M.B. examination 33 out of 68 candidates passed; while five out of seven passed the first and six out of 18 the second M.B. examinations. In the combined Preliminary Scientific and First L.M.S. examinations there were only five candidates, of whom three passed; and 26 out of 30 passed the combined Scientific and First M.B. examinations.

The average number of students attending the Government Medical Schools was 461.

Eastern Bengal and Assam. The Dacca Medical School had 166 students as against 179 in 1904-5, while the Berry-White Medical School at Dibrugarh had 125 as against 96. At the Second Licence Examination there were 38 successful students from the former and 18 from the latter.

United Provinces of Agra and Oudh. The number of pupils attending the Agra Medical School in 1905-6 was 317 (including 75 women), or 20 more than in the preceding year. The results of the final examinations of the men were excellent. Of the 15 female candidates only seven were successful, but one of them, Ram Pyari, gained all the three medals and the prize offered to women. A hostel to accommodate 168 students was opened in October, 1905. The dissecting-room is being enlarged, and a new lecture theatre and class-room have been provided.

Punjab. Lack of material for anatomical purposes has necessitated a restriction of the numbers admitted into the Medical School, while the raising of the literary test for entrance also contributed to the reduction. The average attendance at the Lahore Medical College and School fell from 599 to 552. Of these 260 were in the College and 292 in the Medical School. The percentage of passes in the examinations for the medical degree were not high, but those for the hospital assistant diploma yielded excellent results. The results of the year's examinations show that for the Preliminary Scientific Examination 41 out of 89 candidates passed. In the first L.M.S. and M.B. examinations 26 candidates out of 76 passed, and in the second

L.M.S. and M.B. examinations 19 out of 28 passed. In the School department 102 candidates went up for the final examination for the hospital assistant diploma and 80 passed, or 78 per cent.

The North India Medical School for Christian women at Ludhiana had 38 students on the rolls at the end of 1905, or five less than in the previous year; of these 15 belonged to the Medical Assistants' class, five to the Compounders' class, 12 were being trained as nurses and the rest as *dais*.

Madras.

The strength of the Madras Medical College during 1905-6 was 189. At the final L.M. and S. and M.B. and C.M. examinations the College passed 33 and 46 per cent. of the candidates sent up. In the School department the students numbered 149 (including 20 women) and for the final examination for the Apothecary grade 19 candidates appeared, 17 of whom passed.

The medical schools at Rayapuram, Vizagapatam and Tanjore combined had on their rolls 262 pupils, and of these 51 appeared at the final examination of hospital assistants and 39 passed. All these schools are now under Government management.

Bombay.

The attendance at the Grant Medical College, Bombay, rose from 694 in 1904-5 to 697 (including 40 women) in 1905-6. For the first L.M.S. examination 181 candidates presented themselves, of whom 95 passed; and for the second L.M.S. examination 101 passed out of 187 candidates. For the final examination for the degree of L.M.S. there were 172 candidates, and of these 50 passed, two of whom were women.

The Government Medical Schools at Poona, Ahmedabad, and Hyderabad (Sind) continued to work satisfactorily. The combined average daily attendance was 287.

Central Research Institute, Kasauli.

This Institute has been fully equipped with apparatus requisite for six to eight workers. The duty of preparing sera has been transferred to it from the Pasteur Institute. In March, 1906, the staff of the Institute began an investigation in connexion with the etiology and spread of enteric fever in India. Two officers have received a two months' course of instruction in technique, qualifying them for investigations connected with malaria, *kala-azar*, and blood diseases generally. In March, 1906, the staff of the Institute began an investigation of the etiology and spread of enteric fever in India.

King Institute of Preventive Medicine, Guindy, Madras.

The institute is divided into two sections, the vaccine and the bacteriological. It serves as a training centre for sanitary assistants, vaccinators, and plague inspectors, and the laboratories, which are well equipped, are available for the instruction of officers and for research work. The Vaccine Section supplied lanoline vaccine paste sufficient for 1,633,250 cases. The difficulties of production caused a shortage of supply in the summer months. The laboratories of the Bacteriological Section were increasingly utilised, especially in connexion with plague specimens. Samples of water, &c., were examined in connexion with public health work. Several medical officers used the laboratories for research or instruction. Lectures were given in sanitary engineering, vaccination, and bacteriology.

Pasteur Institutes.

The steady increase in the number of patients treated at the Kasauli Institute continued during 1905-06, and 1,145 people were treated for bites from rabid animals, including 342 Europeans. Patients came from every province and from outside areas, while 172 patients were from the British Army and 82 from the Native Army. In addition to the anti-rabic treatment the Institute undertook the preparation of anti-diphtheritic serum and of anti-venene. A considerable amount of research work was carried out, and bacteriological examinations, serum diagnosis, &c., were conducted. A Pasteur Institute for Southern India is being established at Coonoor.

VII.—SANITATION.

Bengal. In the reconstituted province of Bengal there was an increase of expenditure on conservancy and drainage by municipalities in 1905 as compared with 1904, but a smaller outlay on water-supply than in 1904, when it was exceptionally high. There is considerable activity in municipal sanitation, especially in regard to latrines and schemes for surface drainage. Attention has been directed to the biological method of sewage disposal.

A capital outlay of £67,000 is being incurred by Howrah in carrying out drainage schemes. Plans for the improvement of drainage were also in progress in Titaghar, Cossipore-Chitpur, Puri, and several other municipalities. In the towns of Monghyr, Khulna, and Barisal schemes for extending or improving the water-supply were in preparation. The sanitary work performed by district boards included preventive measures against cholera, plague, &c., sanitary arrangements at fairs, and improvements in village sanitation by clearance of jungle, excavation of roadside drains, and the filling up of hollows containing stagnant water.

The Sanitary Board held only two meetings during the year, and continued to advise the Government and local bodies on important projects relating to waterworks and drainage. The Board proposed modifications in the rules for the preparation of drainage and water-supply schemes. An Assistant Engineer is to be appointed to supervise such schemes.

Calcutta. Progress has been made with the suburban drainage scheme, but the difficulties connected with the syphon under Tolly's Nullah remain unsettled. The greater part of the estimated amount of £97,000 for improving the filtered water-supply has been expended, and a further outlay of £8,500 for two new filter beds at Pulta has been sanctioned. Better maintenance of the pumping engines, and the laying of new and larger mains, are among the improvements effected. The conservancy arrangements have been improved during the year. A final decision has not yet been reached regarding the initiation of the great city improvement scheme.

Eastern Bengal and Assam. In the reconstituted province there are 44 municipalities. The conservancy system in Dacca is unsatisfactory, and schemes for drainage and other sanitary improvements are being considered. Proposals for waterworks are under discussion at Chittagong, and in other towns. The Gauhati waterworks were entirely remodelled in 1905. Most of the districts report improvements in the water-supply of the larger villages by excavating and cleansing tanks and digging wells.

A Sanitary Board was formed but no meeting was held during the year.

United Provinces of Agra and Oudh. In the United Provinces of Agra and Oudh many sanitary improvements in various directions were effected during the year 1905. Good progress was made with the drainage works at Benares, Cawnpore, Agra, Mirzapur and Lucknow, and many other drainage schemes are projected or in progress. The waterworks at Agra, Allahabad, Benares, Cawnpore, Lucknow and Meerut gave excellent results, and extensions were in progress. The Government have relieved the municipalities of police charges to the extent of over £23,000, and this sum is being expended chiefly on plague measures and sanitation. Experiments were made with regard to new methods of treating domestic sewage.

The Sanitary Board held four meetings during the year at which they considered and approved projects, amounting to over £125,700, for improving the sanitary condition of municipalities. The Sanitary Engineer's report on the quality of the several municipal water-supplies was very satisfactory. The Board approved a large number of schemes for drainage and sewerage works. The appointment of an Assistant Sanitary Engineer has been recommended.

Punjab. Progress was made with various drainage and water-supply schemes in the Punjab. Measures are being taken at Lahore and Simla to check the waste of water. There was a marked increase in the number of municipalities that dispose of sullage to cultivators for sewage irrigation. The drainage schemes for Delhi, Multan, Rawal Pindi, Amritsar, and Umballa have been put in operation and good progress made. An estimate of £26,700 for waterworks at Ludhiana was sanctioned. Continued attention was given to village sanitation, and progress

was made in the clearance and protection of wells. Several works of public utility that serve sanitary purposes, such as wells and rest-houses, were constructed by private individuals at their own expense.

Five meetings of the Sanitary Board were held during the year, when several drainage and water-supply schemes were considered and approved and forwarded to the Local Government for disposal.

North West Frontier Province.

No important sanitary work was carried out in the North-West Frontier Province in 1905, but considerable sums were expended on minor works for water-supply and drainage in the municipal towns, especially in Peshawar, the sanitary state of which is very creditable. Progress was made with drainage schemes in Kohat.

Burma.

The municipalities of Burma spent 45 per cent. of their income on sanitary works. Of the district funds less than 5 per cent. was devoted to sanitary purposes. No progress in village sanitation can be recorded. The villagers are said to be apathetic and heedless of the filth of their surroundings. Improvements in water-supply are especially needed. The Hlawga water-supply scheme at Rangoon, designed to augment the supply from Victoria Lake, was opened in February, 1905, but to ensure an abundant supply increased pumping power and improved means of distribution are required. An estimate for an improved sewerage system at Rangoon has been sanctioned. The Moulmein water project has been completed, while estimates for waterworks for Akyab have been sanctioned. The revised scheme of water-supply for Mandalay is still pending. Schemes for drainage and waterworks in several minor municipalities were in progress.

The Sanitary Board held two meetings. In future there are to be four meetings a year, and the functions of the Board will be purely consultative.

Central Provinces and Berar.

No new sanitary work of importance was undertaken in the Central Provinces and Berar during 1905. There was considerable activity in conservancy and other sanitary matters in many municipal towns, especially in Nagpur. Nagpur, Seoni, and Bhandara spent considerable sums in improving their water supplies. A comprehensive drainage scheme for Nagpur was under consideration. Drainage schemes for Khandwa and Burhanpur are also contemplated. In the villages expenditure was incurred for improvement of village sites and surroundings, the construction of new wells and repair of old ones.

Meetings of the Sanitary Board were held during the year in every district. A record of desirable works of village sanitary improvement has been prepared in some districts. A special grant of £4,759 for improving village water-supplies, &c., was expended, and it is hoped that a water-supply will be provided in all localities in need of it.

Madras.

Estimates for many water-supply and drainage schemes were submitted in Madras Presidency. The Coonoor, Guntur, and Dindigul waterworks were completed, and similar works were commenced at Vellore, while schemes for Salem and Coimbatore were examined. A drainage scheme for Madura town was under discussion. Many towns still lack proper water-supply and drainage, and some suffer seriously from congestion and lack of proper sanitation, owing to lack of funds or the slackness of municipal councils. Attention has been drawn to the serious question of congested areas and overcrowded dwellings. Ryots are exhibiting less caste prejudice in the utilisation of night-soil as manure. More energetic stimulation of Local Fund Boards by medical and sanitary officers is said to be desirable. No Board had yet provided a piped public water-supply.

The Sanitary Board scrutinized the plans and estimates relating to 101 sanitary works, estimated to cost £423,870, and 66 were approved.

The important scheme initiated some years ago in Madras of training sanitary inspectors has worked with marked success, and 517 inspectors have been registered as having undergone complete courses approved by Government.

Madras City.

In Madras City good progress was made with the new drainage scheme, which should remedy the most serious sanitary defects, and a number of minor improvements in sanitation, drainage, and water-supply were carried out. Estimates have been prepared for important schemes to improve the water-supply. The cost is estimated at £150,000.

Bombay.

Progress in sanitation in municipal towns has once again been retarded by financial difficulties arising from expenditure on plague. Hence many urgent schemes of

water-supply and drainage could not be carried out. Altogether £26,559 was spent on new works under these heads. With the exception of Ahmedabad no municipality of the Presidency was in a condition to undertake costly works. At Ahmedabad the extension of the drainage has cost £100,000, but a further outlay of a like amount is necessary to complete a sewerage scheme for the whole city. The waterworks of Ahmedabad also require extension and improvement. Arrangements were in progress for the extension of the Karachi drainage, for which a loan of £36,700 has been raised. Estimates for a water-supply scheme for Poona were under discussion, as also a drainage scheme. The Village Sanitation Act was in force in 234 villages against 261 in the previous year. The Act provides for the establishment of a sanitary committee or a sanitary board, consisting of members chosen by the collector of the district or by the local Government to supervise sanitary matters. Sanitary inspection books had been introduced into 3,410 villages, and in 89 per cent. of these the books had been written up by officers of the Sanitary Department. Sanitary officers made suggestions for the improvement of village water supplies, surface drainage and conservancy.

The Sanitary Board considered the question of financial and technical assistance to municipalities to stimulate progress on sanitary works, and submitted recommendations to Government.

Bombay City.

In Bombay City progress was made with the Malabar Hill sewerage scheme. Other sewerage schemes were also undertaken. The lakes and reservoirs which supply the city with water were maintained in good condition. The rainfall, however, was below the average of the quinquennium. In the course of the year 512 new water connections were made and 245 were cut off, leaving a total at the end of the year of 21,188.

INDIA OFFICE,
5th June, 1907.

ABSTRACT OF THE REPORT OF THE SANITARY COMMISSIONER WITH THE GOVERNMENT OF INDIA FOR 1905.

Meteorology of the Year.

The chief meteorological features of the year 1905 were—

(1) The severity and persistency of the cold weather conditions as shown by the amount of snow and rain in Northern India, and the lowness of the temperature over the greater part of the country. This low temperature lasted until the end of April.

(2) The lateness and scantiness of the monsoon rains, especially in North-West India, and the consequent high temperature.

(3) The extreme weakness of the retreating monsoon in the Peninsula, except in Malabar and the extreme south of the Madras Presidency.

During the first twenty days of January weather was feebly unsettled in Northern India with occasional showers in the plains and snow in the hill districts. Temperature there was accordingly very unsteady, but the departures from the normal were at no time very large or important. In the Peninsula, on the other hand, weather was generally dry, and temperature moderately high during this period. On the 21st a fairly deep depression entered Northern India from the west, and occasioned heavy precipitation in North-West India, and showers in the north-east. It was followed by a very strongly-marked cold wave, which appeared on the north-west frontier on the 21st, and advancing across Northern India during the next five days reached Upper Burma on the 26th. Maximum or day temperatures were from 12° to 32° and the night temperatures from 8° to 26° below the normal during this period, and severe frost was experienced both on the hills and plains, a number of stations registering the lowest night temperatures on record. As usual during the cold season these low temperature conditions did not extend to Madras. A second depression appeared in Baluchistan towards the close of the month, and gave showers in North-West India.

February opened with unusually low temperature over the whole country, except in the extreme south and Burma. These low temperature conditions lasted throughout the month, but were, on the whole, most marked during the first three days, during which period a large number of stations experienced much lower temperatures than any previously on record for February. Sharp frost occurred in many parts of Northern and Central India. On the mean of the whole month temperature was in very large defect in Northern India and the Deccan, the defect ranging from 5° in the Deccan to 9° in the Upper Sub-Himalayas. The day temperature was more affected than the night temperature, and in consequence the daily range was much smaller than usual. Weather, on the other hand, was warmer than usual in Madras.

The cold weather which ordinarily does not outlast the end of February was in the present year prolonged into March and the greater part of April. Five depressions in all affected the weather in March. Two of them were important and gave fairly heavy rain over Upper India and very heavy falls of snow in Kashmir. Practically no rain occurred during the month in Lower Sind, Gujarat, Western Rajputana, Bombay, and the west of the Central Provinces, and of the Deccan, as well as within small areas over the South Madras coast and the coast of Lower Burma.

Temperature in March was as markedly in defect as during the two preceding months; the only exceptions occurred in South Madras, Mysore, and the Tenasserim Coast.

In April conditions were, on the whole, less disturbed than they had been since the beginning of the year. The precipitation of the month exceeded the normal in Bengal, the Central Provinces and Madras, but was normal or in defect in the remainder of the country; the defect was most pronounced in Burma, where the usual thunderstorms were almost entirely absent. The most noteworthy feature of the

meteorology of the month, however, was the abnormally low temperature over nearly the whole of the Indian region. The defect was considerable to large over Northern India, where both day and night temperatures averaged from 4° to 7° below the normal.

In May a considerable change occurred in the conditions that had prevailed so far. Little or no rain fell over the dry area in the north-west, and the precipitation of the month was less than the average in all districts excepting Upper Burma, Bengal, Orissa, Ganjam, the east and centre of the Central Provinces, and parts of the south and south-west of the Peninsula. Accordingly, the low temperatures of the previous four months disappeared, and were replaced by an excess except in North-East India, the Gangetic Plain, and the coast districts of the Peninsula.

June was unusually dry over by far the greater part of the country. The monsoon rains were greatly retarded on both sides of India, not setting in till the 10th on the Bombay Coast, and the 29th in Bengal. The Arabian Sea current was weak and unsteady, and it was not until the 27th that it penetrated into the interior. The rainfall was in excess of the average in Burma, Assam, and the south of India, and in those regions the temperature was in very slight defect. On the other hand, in the remainder of the country where the rainfall was less than the average, the temperature was much above the normal, the excess amounting to 8° in Chota Nagpur.

In July the rainfall of the month was lighter than usual, and the temperature above the normal over a considerable part of the country. At the commencement of the month a fair amount of rain was falling over the Peninsula, the central parts of the country, and North-East India, but very little elsewhere. There was, in consequence, a considerable excess of temperature over Northern India, a slight excess over the Peninsula, and a considerable deficiency over the central parts of the country across the head of the Peninsula. This distribution of temperature continued till the 5th; between the 6th and the 10th the temperature conditions were largely controlled by the rainfall of a depression which passed westward from Bengal through the central parts of the country and disappeared on the 10th. During this period the mean temperature was steadily high over North-West India and over the Peninsula, and low elsewhere—more particularly at the central stations. A great change then occurred. A shallow storm appeared at the head of the Bay on the 11th, and passing through West Bengal, disappeared over the United Provinces on the 15th. A strong flow of monsoon winds into Northern India occurred during this period, occasioning fairly heavy general rain, and bringing about a great reduction of temperature. The greatest deficiency was shown in the day temperature which was from 15° to 27° below the normal at several stations in the Punjab and Kashmir. During this time there was no rain of importance over the Peninsula, and the mean temperature ranged above the normal. As the rainfall grew lighter and contracted in the north this area of excessive temperature spread northward, and on the 16th, 17th, and 18th the mean temperature exceeded the average in nearly all parts of the country, except Burma and North-East India. Between the 19th and 25th another depression passed from the head of the Bay westward, as far as lower Sind, occasioning rain over the central parts of the country and the Peninsula. The rainfall was heaviest over Gujarat, and the greatest depression of temperature was reported from that area. Showers fell over the North-West Himalayas and neighbouring districts on the 23rd, and the mean temperature was lower than usual over the North-West Frontier Province for some days. In other parts of the Indian land area the mean temperature was generally higher than usual between the 20th and the 28th. On the 27th a fresh depression appeared over Bengal and marched northward through that province. Rain fell over Burma and in the north-east, and the mean temperature became lower than usual over these areas.

August was even drier than July, the total rainfall of the month being below normal in all parts of the country with the exception of Assam, Bengal, Bihar, and Madras. The deficiency was greatest in North-West India, which obtained only 20 per cent. of its normal supply. Temperature in consequence was more or less above the normal over the whole of the Peninsula and North-West and Central India; the excess was most marked in Rajputana and the adjacent districts of the Punjab, where it averaged nearly 6° in amount. The heat in the north-west was most intense between the 19th and 21st, when maximum temperatures ranging up to 111° and from 10° to 15° above the normal were recorded at several stations.

During September rain occurred frequently in Burma and North-East India, and the mean temperature there was below the normal; over the remainder of the country, however, rain was infrequent or light, and the heat was greater than usual. The excess of temperature was not so great as in August. The most striking features of the temperature conditions were: (1) a large excess in North-West India during the first ten days of the month; and (2) a large defect over the whole of Northern India from the 11th to 17th. Conditions were very steady over the greater part of the Peninsula, where, on most days, temperature was above the normal.

Weather was less disturbed than usual in October, except in Burma, Assam, parts of Bengal, and the south of the Peninsula, where the retreating monsoon current was somewhat more active than usual. During the first four days of the month the weather was very quiet, and there was little rain beyond light showers in the north-east. In consequence, the mean temperature, except in parts of Assam and Bengal, was generally above the normal, the excess being greatest, and amounting to 5°, over Rajputana and the neighbouring parts of the United Provinces and over the Bombay Deccan and Khandesh. On the 5th rain commenced over the southern half of the Peninsula, and fairly heavy daily rain continued over that region from the 5th to the 21st, when, owing to the formation of a depression over the Bay, and the consequent diversion of the moist current from the south of the Peninsula to the depression area, the fall somewhat abruptly ceased. In consequence of the above rainfall, the mean temperature of the Peninsula was generally lower than usual. During this period temperature over Northern India was unsteady and varied by small amounts from the normal. On the 11th, 12th, and 13th there was some snow and rain over Kashmir and light rain over the Punjab. In consequence a decided fall of temperature took place in the north-west, and in some division the mean daily temperature was reduced to below the normal. On the 14th and 15th it became rapidly hotter in Sind, and these high temperatures spread eastward over Gujarat, Rajputana, and Central India. On the 21st a large shallow low-pressure area lay over the Bay of Bengal, and rain was falling over Burma, deltaic Bengal, Orissa, and the Circars; the low-pressure area gradually concentrated, and on the 23rd a depression was shown off the coast near Vizagapatam. This depression advanced north-north-eastward and north-eastward up the coast, entered Bengal on the 25th, and then passed eastward through Upper Burma and Cachar during the 26th. The storm occasioned a considerable fall of rain in the north-east, and the temperature over Burma, Assam, and Bengal was somewhat lower than usual. During this period the mean temperature was very excessive in the north-west. From the 27th to the end of the month the weather was practically rainless throughout the country, and the mean temperature was generally above the normal, more especially in the north-west, where the average excess ranged between 2° and 10°.

Quiet weather prevailed over the Indian land area during November. From the 1st to the 9th the only rainfall reported was some scattered showers, mainly over Burma, Assam, and the extreme south of the Peninsula. During this period the most marked feature of the weather was the excessive heat prevailing over North-West India, where the mean temperature varied between 4° and 10° above the normal. Temperature was also higher than usual, though to a less extent than in the north-west, over North-East India, the showers in that area having been less frequent and less heavy than usual. On the 10th moderate to heavy rain set in over the southern half of Madras. The rainfall diminished both in amount and extent between the 12th and the 16th, extended again on the 17th and 18th, was light between the 19th and 23rd, but became heavier and more general on the 24th, and subsequently extended along the West Coast reaching as far north as Bombay, Poona, and Ahmednagar on the 27th and 28th. During the period from the 11th to the 15th the temperature was unsteady over Northern India, but was very high over North-West and Central India. On the 16th a fall took place, but, though the mean temperature in the north-west was lowered, the fall was not sufficiently large to bring it below the normal in that area. In the north, east, and centre, on the contrary, the mean temperature fell to below the normal, and remained normal or below till the 24th. On the 25th a decided increase of temperature occurred over the Peninsula, and though the rainfall over the south of the Peninsula, the West Coast, and the Bombay Deccan temporarily made the air cooler than usual in those regions, the interior of the Peninsula remained warmer than the average until the close of the month. In North-West India the temperature remained high during this interval, while in North-East India it was generally normal or below the normal.

Quiet weather prevailed over the Indian region during the first week of December, and the only rainfall reported was a few showers over the south of the Peninsula. The mean temperature was at the commencement of the week generally higher than usual, except over the north-west and the north-east, but temperature gradually fell, and on the 6th, 7th, and 8th was below the average, except in Burma. The deficiency of temperature was especially marked over the centre of the country. On the 8th a barometric depression, which had apparently advanced in a northerly or north-easterly direction from the south of the Bay, was shown over the east of the Bay off the west of the Andamans. It advanced in a north-easterly direction during the next two days, and apparently broke up near the Arakan Coast. It occasioned rainy, unsettled, weather over the Andamans and Burma between the 6th and the 10th, and brought about a considerable fall of temperature in the Andamans on the 6th and 7th, and in Burma between the 8th and 10th. Between the 8th and the 11th temperatures lower than usual prevailed over the greater part of the Indian area, but on the 12th a rise set in, and by the 14th the mean temperature generally exceeded the normal, except over the central districts and along the West Coast. Light showers of snow occurred on the North-West Himalayas between the 13th and 15th, and temperature was unsteady in the extreme north-west, but on the 16th, 17th, and 18th a rise took place, and on the 18th, immediately before the appearance of the second storm of the month, the mean temperature was very high over the whole of North-West India. On the 19th a shallow depression was shown over the Punjab and neighbouring regions, and moderately heavy rain was falling over the North-West Frontier Province and the Punjab. A slight cold wave succeeded this precipitation, and passed slowly across Northern India between the 20th and the 25th. It was succeeded by very high temperatures in the north-west, which, in their turn, extended eastward over the central parts of the country. On the 29th, 30th, and 31st light showers fell in the north-west and north-east, and temperature was reduced to below the normal in both areas; but over the remainder of India the mean temperature was generally in excess of the normal during this period, and in parts of the Deccan, the Central Districts, and Bengal the excess was considerable.

The mean temperature of the whole Indian land area for the year was only 0·4° in defect; the defect was shown entirely in extra-tropical India, temperature being 0·1° in excess in tropical India. It was above the normal in all months of the year with the exception of the first four and December. The defect was unimportant in December, but equalled 4·7° in February and 3·0° in March and April. The excess, on the other hand, was greatest in June, the month of greatest deficiency of rainfall.

The mean pressure of the year was ·009 inch higher than usual. The excess was much more marked in the Peninsula than in Northern India, averaging ·014 inch for the former and ·003 inch for the latter area. The most striking feature of the pressure conditions during the year was the large excess in April and November, associated in the former month with a considerable depression, and in the latter with a moderate elevation of temperature.

The year was drier than usual. The mean relative humidity of the air was slightly below the normal. This dryness was solely a result of a large deficiency of aqueous vapour, the pressure of which was ·012 inch below the normal.

The mean cloud amount was above the normal from January to March, and below it during the remainder of the year. The cloudiest month relative to the normal was March (+ 1·2), and the skies were least overcast in June, when the mean cloud amount was 1·1 below the normal.

The rainfall of the year exceeded the normal over Burma, Assam, Bengal, Bihar, the east submontane districts of the United Provinces, the Central and West Punjab, the North-West Frontier Province, the west of the Central Provinces and Baluchistan, but was lighter than usual in all other parts of the country. The deficiency was largest in Rajputana, Sind, the South-East Punjab, and the Western and Central Districts of the United Provinces, where it ranged between 48 and 62 per cent. The greatest excess, on the other hand, occurred in North Bihar, Central, and Deltaic Bengal and Baluchistan, which received 23 to 32 per cent. more than their normal amounts.

The deficiency of rainfall was not distributed over the whole year, but occurred almost solely in the period June to September.

European Troops.

(For Statistical Tables, *see* pages 127 to 133.)

Sickness and mortality in 1905.—The average strength of the European Army of India during 1905, excluding officers, was 71,343 as compared with 71,083 during 1904, the number of new arrivals in the country during the corresponding trooping seasons having been 15,178 and 16,366 respectively. From the following table it will be seen that the health of the British troops during the year has been exception-

India.	All Causes. Ratios per 1,000.		
	1899–1903.	1904.	1905.
Admissions	1100·6	900·4	834·3
Constantly sick	68·05	57·0	52·3
Deaths	13·46	10·83	10·05
Invalids	33·99	35·27	21·24

ally good, the rates of admission into hospital, of constantly sick, of mortality, and of invaliding all being the lowest on record; and this is the more satisfactory as 52 per cent. of the strength were under 25 years of age, and 25 per cent. had less than one year's service in India. Taking India as a whole, the healthiest months were March, April, May, and June, and the most unhealthy August, September, and January.

The chief causes of sickness were venereal diseases, ague, and simple continued fever, which accounted for 18·42, 13·35, and 5·74 per cent., respectively, of the total number of admissions from all causes. The decrease in sickness was due chiefly to the diminution in the number of admissions on account of ague and venereal diseases. The admission rate for ague was 111·4 per mille against 174·0 in 1904, and an average of 311·2 in the preceding decennium; that for venereal diseases was 153·7 against 198·5 in 1904, and 385·5 for the decennium. Enteric and remittent fevers also show diminished admission rates in comparison with those of 1904 and of the decennium, but the rates for simple continued fever, influenza, and small-pox rose from 23·7, 4·9, and ·7 per mille, respectively in 1904 to 47·9, 14·2, and 1·4, respectively, in the year under review. How far the diminution in the admission rate of ague is due to a real reduction in the prevalence of the disease as a result of more effective prophylaxis and treatment, and how far it may be explained by the increasing admission-rate of simple continued fever, is difficult to gauge exactly, and in this connection a reference may be made to the remarks in the subsequent paragraph upon simple continued fever.

The main causes of death were, as usual, enteric fever and hepatic abscess, the former accounting for 29·7 per cent. and the latter for 11·7 per cent. of the total number of deaths. The mortality from each of the chief diseases, with the exception of heat-stroke, pneumonia, and dysentery, was less than in the previous year.

The main causes of invaliding were, in order, debility, ague, tubercle of the lungs, valvular disease of the heart, disordered action of the heart and syphilis, these causes together accounting for over two-fifths of the total. There was a notable decrease (from 645 in 1904 to 315 in 1905) in the number of men sent home on account of ague, tubercle of the lungs, and syphilis. Only 23 men were invalided for *Bilharzia hæmatobia* as compared with 71 in 1904 and 158 in 1903.

The admission-rate of European troops during 1905 was nearly one and a half times as high as that of native troops, and the constantly sick and invaliding rates were more than twice as high. The death-rates of European and native troops were, respectively, 10·05 and 8·09 per mille.

The average strength of the European troops of the garrison in the Aden Hinterland was 349, and altogether 345 admissions and 3 deaths were reported, giving an admission-rate of 988·5, and a death-rate of 8·60 per mille. Ague, as usual, was the chief cause of sickness, and accounted for 46 per cent. of the total number of admissions. The three deaths were due to pneumonia, hepatic abscess, and intestinal obstruction.

Commands, Divisions, and Stations.—As in 1904, the Northern Command shows lower constantly sick and admission-rates than the Eastern, and the Eastern Command than the Western; and in 1905 these Commands stand in that order also as

regards mortality, the death-rate of the Eastern being considerably higher than that of the Northern. The invaliding rate, as in 1904, was lowest in the Eastern and highest in the Western Command. The admission, constantly sick, death, and invaliding-rates all show an improvement on the corresponding figures of the previous year in *each* Command; but, while the three Commands contribute very equally to the improvement in the constantly sick-rate, the diminution in the admission and death-rates (compared with the figures of 1904) is most marked in the Northern Command. The admission-rate for venereal diseases was highest in the Eastern Command (165·8), and was closely followed by that of the Western (155·4); and in the Western alone was the admission-rate for venereal diseases exceeded by that for ague—the rate for ague in the Western being 162·8 per mille in comparison with 111·4 amongst European troops in India as a whole. The death-rates for enteric fever were approximately the same in the three Commands; those for heat-stroke were about twice as high in the Northern and Eastern as in the Western; those for hepatic abscess were more than three times as high in the Western and Eastern as in the Northern. As regards Divisions, the statistics in the 4th (Quetta) Division were the most unfavourable, showing as they do admission and constantly sick-rates of 1,024 and 60 per mille respectively. The 1st (Peshawar) Division had a higher admission-rate (1,031) but a lower constantly sick-rate (54), and the 9th (Secunderabad) Division with the low admission-rate of 813 had the high constantly sick-rate of 62 per mille. The statistics of the 5th (Mhow), Burma and 3rd (Lahore) Divisions compare most favourably with the corresponding figures of the previous year, but the statistics of the 1st (Peshawar) Division which last year showed the lowest admission and constantly sick-rates (740 and 44 per mille respectively), come next to those of the 4th (Quetta), the most unhealthy of all the Divisions. During 1905, the health of the European troops was most satisfactory in the 2nd (Rawalpindi) and 3rd (Lahore) Divisions. As in 1904, tubercle of the lungs was most fatal among troops in the 6th (Poona) Division, and abscess of the liver among those in the Aden Brigade. Enteric fever was most fatal among troops in the 1st (Peshawar), 4th (Quetta), and 5th (Mhow) Divisions; heat-stroke among those in the Aden Brigade, 1st (Peshawar), 8th (Lucknow), and 3rd (Lahore) Divisions.

Amongst the largest stations, the highest constantly sick-rates were at Lucknow (61·4), Secunderabad (57·9), Quetta (55·4), and Rawalpindi (55); the lowest, at Ambala (48·1). The incidence of enteric fever and hepatic abscess was greatest at Poona and Lucknow, and least at Ambala, Bangalore, and Quetta. In regard to the prevalence of dysentery, however, Quetta came next to Lucknow. Bangalore (20·4), Lucknow (18·4), and Secunderabad (18·3) furnished the highest constantly sick-rates for venereal diseases, and Quetta (7·9) the lowest. Poona, which gave the highest constantly sick-rate for ague (5·4) returned the lowest for simple continued fever (·3); the high rates for simple continued fever of 5·3 and 4·6 were furnished by Lucknow and Quetta, respectively.

Geographical Groups.—The geographical groups which, judged by their statistics, may be regarded as having been the most unhealthy for European troops during 1905, were Bengal-Orissa (IV.), Indus Valley (VII.), Western Coast (X.), Burma Coast (I.), and Central India (VIII.), while at the other end of the scale were the Hill Stations (XII. *a*), Southern India (XI.), and Burma Inland (II.). Comparing the relative position, as to healthiness, of these groups for the past three years (1903-05), it is found that Bengal-Orissa (IV.), Burma Coast (I.), and Central India (VIII.) invariably appear amongst the most unhealthy, and the Hill Stations (XII. *a*) and Southern India (XI.) amongst the healthiest. Omitting Convalescent Depôts (XII.*b*), the highest constantly sick-rates were in Bengal-Orissa (IV.), with 77·3 per mille, Western Coast (X.) with 58·3, and Indus Valley (VII.) with 57·2; the highest admission-rates in Burma Coast (I.) with 1,220·8, Bengal-Orissa (IV.) with 1,160·4, and Indus Valley (VII.) with 1,092·7; the highest death-rates in Bengal Orissa (IV.) with 17·75, Central India (VIII.) with 11·89, and Indus Valley (VII.) with 10·66. The constantly sick, admission, and death-rates of the Hill Stations (XII. *a*) were 45·4, 754·5, and 8·95, respectively, as compared with 52·3, 834·3, and 10·05, respectively, for all India. In these geographical groups the average strength varied from 1,259 in Burma Coast (I.) to 13,724 in Upper Sub-Himalaya (VI.), and in all of them, except four, the admission and constantly sick-rates show a decrease—most marked in Burma Coast (I.), Gangetic Plain (V.), and Central India (VIII.)—on the corresponding figures of 1904. The four groups whose rates compare unfavourably with the previous year's are Southern India (XI.) with an increased constantly sick-rate,

Western Coast (X.) and Hill Stations (XII. *a*) with increased admission-rates, and Indus Valley (VII.) with a considerable increase in both the constantly sick and admission-rates. Ague was most prevalent among the troops located in Bengal-Orissa (IV.) and Indus Valley (VII.); venereal diseases among those in Bengal-Orissa (IV.), Western Coast (X.), Burma Coast (I.), and Southern India (XI.). The mortality from enteric fever was highest in Central India (VIII.), Upper Sub-Himalaya (VI.), Indus Valley (VII.), and Deccan (IX.); in the first two of these groups, it amounted to 41 per cent. of deaths from all causes. Hepatic abscess caused about 17 per cent. of all deaths in Deccan (IX.), Bengal-Orissa (IV.), and Southern India (XI.).

Combining the statistics of all the European troops in India, and comparing the aggregates with those of the previous year, there were, during the year under review, 4,483 fewer men admitted to hospital, 319 fewer men constantly sick, 53 fewer deaths, and 999 fewer men invalided, notwithstanding the fact that the average annual strength of these troops was greater by 260 men. Even if we leave aside the diminished loss from deaths and invaliding, the gain derived solely from the decrease in the number of men constantly sick may be represented as equivalent to the work of 116,435 men for one whole day; this gives an idea of the significance of the above figures.

Influenza.—Influenza was especially prevalent during the year among European troops, the admission-rate, which was 3·1 per mille in 1903, and 4·9 in 1904, rising to 14·2 in 1905. The disease was prevalent in all but one, Southern India (XI.), of the geographical groups, the incidence being greatest in North-Western Frontier and Indus Valley (VII.) and Bengal-Orissa (IV.), which were affected to the extent of 94 and 60 per mille of their strength, respectively. The only other group with a rate above the mean for India (14·2) was Upper Sub-Himalaya (VI.). Some idea of the occasional fluctuation of incidence in the same group from year to year is obtained when it is noted that North-Western Frontier and Indus Valley (VII.), which in 1905 was so severely affected by influenza, was, in 1904, free from the disease. Against 349 admissions with no fatality in the previous year, there were altogether in the year under review 1,014 admissions, with three deaths, reported from 45 stations, of which Peshawar (428), Fort William (97), and Mian Mir (96) contributed 61 per cent. of the total number of admissions. At Peshawar, which, in 1904, furnished no case under this heading, the means by which the disease was introduced could not be discovered. The disease was characterized by the usual symptoms—lassitude, fever, pains in back and limbs, headache, great prostration and debility, and although of a mild type (the case which ended fatally having been complicated by pneumonia) became very prevalent amongst the general population. A careful microscopical examination in each case excluded the possibility of the disease being malaria. Both the intestinal and respiratory varieties were represented; in the former, abdominal pain, nausea, vomiting, and diarrhœa were prominent; in the latter, there was well marked coryza. In all cases convalescence was prolonged and marked by great debility. The epidemic occurred during May and June. For the third year in succession Fort William appears on the list of greatest incidence; the months of maximum prevalence have invariably been August and September. Here also any etiological connection with malaria was excluded. At Mian Mir, influenza was widely prevalent during April and May, and of a mild type, but followed by great debility, and in two cases accompanied by pneumonia.

Cholera.—The troops in the Northern Command remained free from cholera during the year. In India, as a whole, 10 cases, with 9 deaths, were returned during 1905 as compared with 16 cases and 11 deaths in 1904, and 81 cases and 57 deaths in 1903. Of the ten cases during the year, five occurred in November on board the R. I. M. S. "Irrawaddy," which was carrying troops from Mandalay to Rangoon. The cause of infection was attributed to one of these five men having broken bounds and visited a native village, which was afterwards found to be cholera-stricken. All five, who were transferred for treatment to Thayetmyo, died of the disease. Of the other cases, two were reported from Jubbulpore, and one each from Madras, Allahabad, and Dinapore. Cholera is said to have been prevalent in Madras, and to have been introduced by emigrants *en route* to Natal. At Dinapore, the disease was probably contracted in the bazaar, where an outbreak of cholera had occurred after the dispersal of natives from the Sonepore fair. As regards the case at Allahabad, the source of infection was associated with a restaurant outside cantonment limits, but it is not stated if the disease was prevalent in the surrounding district.

Small-pox.—Small-pox was twice as prevalent amongst the European troops during 1905 as during the preceding year, and was reported from all the geographical groups except two—Burma Inland (II) and Bengal-Orissa (IV). The Western Command was chiefly affected, contributing 77 cases (one fatal), while the Northern furnished six cases and the Eastern one only. There were in all 99 cases with one death as compared with 49 cases with four deaths in 1904 and 68 cases with eight deaths in 1903. One or more cases were recorded in 23 stations, the largest numbers occurring in Poona (26), Mhow (19), and Colaba (9). At Poona, the epidemic prevailed from January to May—most of the cases occurring in March, and it is stated that the disease was contracted, in the first instance at least, in the bazaar, where a severe epidemic was raging amongst the natives. All the infected men bore satisfactory marks of vaccination, and none of them had previously suffered from small-pox. No death occurred amongst the 26 men attacked at Poona, while a woman who had not been vaccinated was attacked by the disease and died. The outbreak at Mhow took place in March, and fresh cases continued to occur till June. The disease was prevalent among the native population and the source of infection was traced to the *sadar* bazaar, which is situated near the barracks of the cavalry, who suffered most. None of the patients had previously suffered from small-pox and all had been vaccinated (one man had been vaccinated just a week before he became infected). In the station of Colaba small-pox prevailed from January to March; the disease was severely epidemic in Bombay City, but the source of infection, as regards the troops, was not definitely traced. All the nine men that were attacked had been vaccinated and seven of them revaccinated on one or more occasions.

Ague.—During 1905, a year of abnormally small autumn rainfall, there was exceptionally little malaria among the European troops, intermittent fever being the cause of 13 per cent. only of the total admissions as compared with 19 per cent. during 1904 and 23 per cent. during 1903. The admission-rate for the European army of India as a whole was 111, against 174 in 1904, and an average for the preceding decennium of 311, and the death-rate fell from ·24 in 1904 to ·11 per mille. There was also a coincident diminution in the prevalence of the disease during 1905 among native troops and prisoners, the rates for these (except for that of prisoners in 1896), being the lowest on record. To the reduction in the prevalence of this disease among European troops, all three commands contributed, their admission-rates falling from 202 in the Northern, 212 in the Western, and 129 in the Eastern, to 70, 163, and 113, respectively. The incidence in the Northern thus fell to about one-third of what it was in 1904, and that in the Western, although considerably smaller than in the preceding year, is still the largest in the three commands. The great prevalence of malarial fever in the Western Command was due chiefly to the troops of the 5th (Mhow) Division being particularly affected. Of the ten divisions, the admission-rates were highest among the troops in the 5th (Mhow) Division with 184 per mille of strength, the 1st (Peshawar) Division with 178·9, and the 6th (Poona) Division with 155·6. Among the troops of the Aden Brigade the admission-rate was 286·2 per mille and the death-rate 3·17 against 486·5 and 4·39 per mille, respectively, in 1904.

As regards geographical groups, the greatest prevalence was, in order, in Bengal-Orissa (IV) with an admission-rate of 255·6 per mille, Indus Valley and Frontier (VII), Central India (VIII), Burma Inland (II), and Western Coast (X), and the least in Burma Coast (I) with an admission-rate of 27 per mille, Hill Stations (XIIa) and Upper Sub-Himalaya (VI). Of these, Central India (VIII) and Indus Valley and Frontier (VII) generally take a high place, but the Upper Sub-Himalaya (VI) group which in former years usually accompanied these two (VIII and VII) in the list of groups chiefly affected, appears in 1905 at the other end of the scale with an admission-rate of only 74·6 per mille as compared with 208·8 in 1904. Excluding the Hill Stations, in which the prevalence of malaria depends on the number of infected men arriving from stations in the plains, and comparing 1905 with the previous year, a decrease in the admission-rate is recorded in 49 stations and an increase in 22. If stations in which the annual average strength was below 200 be omitted, the highest rates were recorded at Ahmedabad, Delhi, Thayetmyo and Fort Allahabad, the rates in all being above 400 per mille of strength and being considerably higher than those of the previous year. The admission-rate at Dthalla (Aden Hinterland) was 456 per mille of strength.

The seasonal prevalence of ague is most marked in the Northern Command (May to November) and least in the Western, due doubtless to the effect on the mosquito and the *plasmodium malariæ* of the low temperature during the winter and spring

months in the former command. The influence of temperature on the sexual generations of the malarial parasite and on experimental malaria has been recently investigated by Jancso. Mosquitoes of the species *Anopheles claviger* were infected by being fed on patients suffering from malaria (separate experiments being made for each variety of the malarial parasite), then kept at different degrees of temperature and finally killed, embedded and examined microscopically in sections at stated intervals. If the mosquitoes were kept at 24-30° C., the development of the parasite progressed rapidly and well; at a lower temperature development was prolonged, while at a higher the mosquitoes themselves were unfavourably influenced. If, however, the mosquitoes were kept from the very time of feeding onwards at a temperature below 16° C., no cysts (zygotes) developed; whereas, if, after being kept at a favourable temperature till cysts formed, the temperature was then lowered even much below 16° C., healthy cysts with infective germs were found. The lower limit of temperature permitting the development of the malarial parasites to proceed to the sporocyst stage was 16° C. Jancso also demonstrated that the possibility of infection from the bites of infected mosquitoes is independent of the temperature at which the infected mosquitoes were kept. It would appear, therefore, from these experiments that an infected mosquito even after hibernation may still be infective.

Leaving aside diseases of the nature of relapsing fever, African tick fever, and possibly also yellow fever, in which the specific causative micro-organisms (*spirochætæ*) disappear from the blood with convalescence, immunity in tropical protozoal infections of the human blood, *e.g.*, malaria and trypanosomiasis, is only partial; it is more in the nature of a mutual "tolerance" or symbiosis, the specific protozoon remaining in the body after convalescence. This persistence of the protozoa in the body is possibly due to these small representatives of the animal kingdom being themselves, like their hosts, possessed of the power of producing immune-bodies for self-defence; and this same power may explain the complete failure of serum therapy in these diseases of man. Assuming, therefore, this very natural hypothesis, the methods by which we can hope to combat these diseases are obvious. There is no hereditary immunity or absolute acquired immunity; we cannot rely on the body tissues or fluids being able to rid themselves of these parasites; we have to find some extraneous agent which, while relatively harmless to the host, has a powerful destructive effect on the parasites. For malaria, such an agent we have in quinine. By means of this drug a relative immunity very similar to the acquired immunity of natives may be attained; but the quinine immunity is preferable to the acquired immunity, because natives with the latter, by harbouring the parasite (latent infection), may remain a source of infection long after convalescence. The methods of administering quinine to obtain immunity are various. The various methods of quinine prophylaxis may be divided into two groups, the *rationale* of each group being quite distinct. In the one group, small doses at frequent and regular intervals are given with the object of keeping the blood *always* under the influence of quinine so that the malarial parasite cannot enter the body; in the other group, large doses are administered at intervals of some days in order that quinine may be in such concentration in the blood that the parasites—should they meanwhile have gained an entrance into the body and begun to grow and multiply—are quickly and easily killed, being still in those stages of development most susceptible to the action of quinine. The former is the ideal method, and corresponds closely with natural immunity, but is not practical, for a time comes when owing to some accident or want of foresight the supply of quinine to the blood is not kept up, immunity is lost for a period during which infection may occur, and the administration of small frequently repeated doses, when resumed, may not be sufficient to destroy the parasites that have now established themselves within the human body. For practical prophylaxis the methods of Koch and Morgenroth are most probably the best and quinine prophylaxis can hardly be said to have had a fair trial unless the quinine has been administered in doses of 15 grains on two consecutive days in the week. When anti-mosquito and in particular anti-larval measures are impossible or futile, our only hope of success in combating malaria lies in (1) quinine prophylaxis, (2) segregation and mechanical defence (mosquito-nets, &c.) of healthy and infected alike, and (3) thorough treatment with quinine of malarial patients and cases of latent infection. The importance of rendering natives free from the *plasmodium* is shown by Craig, who found that 62·2 per cent. of adults and 48·3 per cent. of children among the native population in the Philippines were examples of latent infection; and the effect of mosquito-proof wards has been demonstrated by Gorgas on the Isthmus of Panama.

Where quinine prophylaxis is extensively employed as among the European troops in India, the demonstration by the microscope of the malarial parasites in true cases of ague becomes proportionately more difficult; in such cases the increase in the relative number of large mononuclear leucocytes, which seems characteristic of most protozoal blood infections, may be of assistance in coming to a conclusion as to the nature of an illness.

The effect of X-rays in the treatment of malaria has been investigated by Demarchi, who found that these rays have no effect on the course of an attack or on the parasites, but have a favourable action on the chronic large spleen.

Reports from Medical Officers on Malarial Fever.—The more important points brought out by a study of the special malaria reports of stations are here shortly summarized. Of 8,106 cases of malaria among European troops in which the type of fever was diagnosed by clinical methods, 73·78 per cent. were considered by the medical officers to be cases of benign tertian infection, 1·28 per cent. quartan, 5·00 per cent. malignant tertian, ·38 per cent. being cases of "malarial cachexia" and 19·56 per cent. remaining undifferentiated. In 72 stations the microscope was used as an aid to diagnosis and the number of cases in which the diagnosis was thus confirmed was 2,797. In 85·2 per cent. of these, benign tertian parasites were found, in 11·7 per cent. malignant tertian, and in 2·5 per cent. quartan. Quartan fever was recorded in 17 stations and at Port Blair was nearly three times as prevalent as benign tertian. The proportion of malignant to benign tertian infection was highest in Port Blair, Jacobabad, Jubbulpore, Kamptee, and Allahabad, the malignant type being more prevalent than the benign in the first two stations named. At Allahabad, two cases of mixed infection (malignant tertian with benign tertian) were observed. As there were difficulties, however, in differentiating the types of parasites in some cases, the above figures are only approximate. Some medical officers returned cases as malignant tertian only if crescents were found, so the prevalence of this type of fever is probably under-estimated. At Rangoon and some other stations, those cases only in which parasites were found in the blood were returned as malaria, the others being recorded under *simple continued fever;* and the effect of this procedure is well exemplified in the statistics of Mian Mir, where in 1904 and 1905, the admission rates for malaria were 507·4 and 45·7 per mille, respectively, and those for simple continued fever 76·9 and 349·9 per mille, respectively. But the recorded decrease in the prevalence of malaria is by no means wholly accounted for by this change in diagnostic procedure. The influence which the arrival of infected troops may have on the statistics of a station is well seen in the case of Karachi, where the 1st South Wales Borderers, "saturated" with malaria, arriving from Mian Mir in March, caused a rise in the admission rate of the station from 93·6 per mille in 1904 to 245·6 in 1905. At Wellington one man was admitted four times, seven men three times each and eleven men twice each, 19 men thus accounting for 67 admissions. Such results as these show the necessity of segregating and systematically treating with quinine infected troops arriving at a healthy station and also of thoroughly disinfecting (*i.e.*, freeing from parasites) malarial patients and convalescents. In some stations quinine is administered in doses which are far too small, and this is particularly true of the prophylactic dose which, especially in stations which are reputedly malarious, should never be less than 15 grains and should be given on two consecutive days each week during the malarial season. In about eight stations the prophylactic dose was not more than 5 grains given twice a week. At Taragarh, where convalescent and infected arrivals from stations in the plains underwent a systematic course of quinine, viz., 15 grains daily for seven days and then 15 grains twice a week on two consecutive days for a month, there was a total absence of malaria, as compared with 25 admissions (giving an admission rate of 595 per mille) in 1904 when no such precaution was taken. Quinine prophylaxis (15 grains twice a week) was stopped tentatively for a short period at Ahmedabad and the number of admissions for malaria immediately increased. Lastly, the following striking example of the value of quinine prophylaxis is reported from Kamptee: 500 men of the Royal Scots getting 15 grains of quinine sulphate once a week from 1st September to 15th November gave 17 admissions (equivalent to an admission rate of 34 per mille), while 154 men of the 62nd Battery, Royal Field Artillery, that were not taking quinine regularly gave during the same period 20 admissions (equivalent to 129·8 per mille).

At Dum Dum and Dinapore it was observed that quinine tabloids frequently passed almost unchanged through the alimentary canal; quinine was subsequently administered in solution only. Treatment by hypodermic or intramuscular injections

of quinine—chiefly the bihydrochloride, is pretty generally followed and is recognised by many as being more rapid and powerful in its action. This method is found valuable in severe or intractable cases, where the results of administration by the mouth are unsatisfactory, *e.g.*, the desired effect not being produced or, the drug not being tolerated. From Mandalay it is reported that a highly neurotic European woman, six months' pregnant, suffering from malignant tertian fever, received an injection of five grains of quinine bihydrochloride daily until the fever was checked, without the production of any untoward effect on the uterus. In some cases (Dum Dum), where quinine by the mouth was not retained, good results were obtained by giving quinine in rectal injections.

As regards special anti-mosquito measures, the great decrease in prevalence of malaria at Mian Mir is attributed chiefly to the prevention of canal irrigation water from running through cantonments and that at Jubbulpore to the excellent results of the extensive surface drainage carried out near the barracks by the Royal Engineers in 1904. From Peshawar, on the other hand, it is reported that two regiments whose barracks were very near the military grass farm were especially affected during irrigation of this land and had double the admission-rate for malaria of the other regiments not so exposed. The increase of prevalence at Thayetmyo is attributed to the flooding of the country by the Irrawaddy and that at Dum Dum to the neighbouring rice-fields. In Dinapore, however, although anti-mosquito measures were heavily handicapped by the presence of rice-fields all round cantonments, the prevalence of malaria among European troops is less than half, and that among native troops less than a quarter of what it was in 1904. At this station 10 grains of quinine were given under strict supervision on three consecutive days in the week, at first in tabloid form, but latterly, after evidence of the relative insolubility of these preparations, in solution. The decrease of malaria cannot in this instance be accounted for by a change in diagnostic procedure, as admissions on account of simple continued fever have also fallen from 53 in 1904 to 7 in 1905. Consequently, the good results obtained in this station must be attributed principally to quinine prophylaxis and possibly to a less extent to the anti-mosquito measures undertaken. Anti-mosquito operations were carried on methodically and enthusiastically in a number of stations with good results, but in some stations such measures were regarded as impracticable owing to the difficulty of dealing with rice-fields, irrigation canals and other large masses of water in and around cantonments, while in others the efforts of the military authorities were to a great extent rendered futile by the mosquito breeding grounds near cantonments being under the jurisdiction of municipal commissioners who could not be prevailed upon to co-operate. To attain complete success in the campaign against mosquitoes, the systematic concerted action of all residents is necessary. The absence of *anopheles* from Jubbulpore is attributed to the lasting effects of the extensive surface drainage referred to above. In most stations malarial patients were, whenever possible, isolated in special wards and supplied with mosquito curtains; the latter, however, the men did not seem to appreciate. At Ambala, the hospital doors were self-closing and fitted up with wire gauze; at Poona the wards were mosquito-proof. The prevalence of malaria in the Aden Brigade is attributed to the indifference of the men to precautions especially during expeditions into the interior. At Aden itself there is very little malaria, because of the high winds and the absence of vegetation: a few *anopheles*, however, are present—due, in the opinion of the Senior Medical Officer, to the larvæ being introduced with the water supply. In the Aden Hinterland the prophylactic use of quinine was continued throughout the year and the camp on the line of communications was removed to a site a mile further away from the river—measures which have been followed by good results. The effect of methylene blue in malaria was tried at Ahmedabad and Calcutta; in the former station the results are reported as favourable, in the latter as unfavourable. At Kamptee the action of the Italian remedy, *fevrolo*, which is said to have a rapid and powerful lethal effect on the malarial parasite, was tested, but no opinion on its value is expressed. Judging, however, from the temperature charts, this powder does not seem to have any very rapid lethal effect on crescents and apparently after three or four days' administration was invariably displaced by quinine. *Anopheles* were reported during the year in 52 stations in the plains and in 47 of these identification of the species present was attempted. The presence of *A. rossii* was noted in 36 stations, *A. culicifacies* in 20, *A. stephensi* in 7, *A. fuliginosus* in 6, *A. nigerrimus* in 5 and *A. listoni* in 3. Other species mentioned were *A. maculatus*, *A. theobaldi*, *A. barbirostris*, *A. jamesi*, *A. fluviatilis*, and *A. lindesayi*. The

malarial "endemic index" was given by 14 stations but as in all instances except one, the number of children examined was very small, much value cannot be attached to the results.

Remittent Fever.—The admission-rate on account of remittent malarial fever was 2·3 per mille as compared with 3·4 in 1904 and 13·5 for the decennium (1894-1903). This fever was more than five times as prevalent in the Western and Eastern Commands as in the Northern. As regards geographical groups the admission-rate was highest in Burma Coast (I), where, in contrast with those for India as a whole, the rates are on the increase, being 26·2 per mille as compared with 14·6 in 1904 and 6 for the decennium. The greatest diminution in the admission-rate has occurred in Bengal-Orissa (IV), where the rate has fallen from 34·5 for the decennium and 28·4 in 1904 to 4·7 in the year under review. Southern India (XI) recorded no case during the year. The decrease in the admission-rate of European troops during the year has been coincident with a fall in the death-rate, which was ·14 per mille in 1903, ·10 in 1904, and ·01 in 1905.

The seasonal incidence for India, taken as a whole, corresponds closely with that of intermittent fever; and it is impossible to say how far the reduction in the reported admission-rate of remittent fever can be taken as indicating a diminished prevalence of the severer forms of malarial fever. In this connection it may be noted that several medical officers report that the prophylactic use of quinine, even although occasionally it may not produce any great decrease in the incidence of malaria, has some mitigating influence on the severity of the attacks. A considerable part of the reduction, however, is probably due to more careful diagnosis and the more frequent use of the microscope for diagnostic purposes. It is noteworthy that of the five large stations, above mentioned, in which intermittent fever was most prevalent during the year, four—Ahmedabad, Thayetmyo, Fort Allahabad, and Dthalla, have not returned a single case of remittent fever; on the other hand Mhow recorded 39 cases, Port Blair 33, Delhi 20, and Dinapur 12; such facts as these suggest that the diagnostic procedure followed by the various medical officers is a factor influencing remittent fever returns.

Simple Continued Fever.—Since 1902, the admission-rate on account of simple continued fever has increased in a striking manner. The accompanying tabular statement gives the admission-rates of intermittent and the commoner continued fevers and the total admissions of the less frequent continued fevers :—

Year.	Admission-rates per 1,000 of strength.						Actual Admissions.				
	Intermittent.	Remittent.	Simple Continued Fever.	Influenza.	Enteric Fever.	Intermittent, remittent, simple continued, influenza and enteric fevers combined.	Dengue.	Cerebro-spinal Fever.	Malta Fever.	Relapsing Fever.	Dengue, cerebro-spinal, Malta and relapsing fevers combined.
1891–1900 ...	346	15	35	7	24	427	199	2	3	—	204
1901 ...	293	6	24	9	13	345	—	1	5	—	6
1902 ...	247	7	14	2	17	287	298	1	8	1	308
1903 ...	243	4	18	3	20	288	303	—	9	—	312
1904 ...	174	3	24	5	20	226	439	—	6	—	445
1905 ...	111	2	48	14	16	191	415	2	4	—	421

Amongst the former group of fevers, the progressive diminution of the rates for malarial fevers is worthy of note, as is also the coincident increase during the past four years of those for simple continued fever and influenza; amongst the latter, the increase during recent years in the prevalence of dengue, which, however, affects only Madras and Burma, is deserving of notice and is probably explained, as pointed out in this report for 1904, by the more accurate diagnosis of malarial fevers. It is also to be noted that the totals of the ratios of intermittent and the commoner continued fevers show a continuous decline. The admission-rate of simple continued fever during the year was 47·9 per mille, which is double that of 1904, and also considerably greater than that of the decennium 1891-1900, a period during which many other continued fevers, *e.g.*, enteric fever, Malta fever, cerebro-spinal fever, influenza, &c., which were not so well recognised and differentiated as they now are, were doubtless frequently returned under the heading of simple continued fever.

All the commands contribute to this rise in prevalence of simple continued fever, but chiefly the Northern and Western, the admission-rates of which in 1905 were about three times as great as those in the preceding year. As regards geographical groups, all show an increase of incidence except Bengal-Orissa (IV) and Sanitaria (XIIb), the highest admission-rates being in Burma Coast (I) and Gangetic Plain (V) with 136 and 104 per mille, respectively, and the lowest in Western Coast (X) and Central India (VIII) with 2 and 9 per mille, respectively. The stations, with a strength of over 200, at which the highest rates were reported, were Mian Mir (350 per mille), Meiktila (232), Jubbulpore (172), Lucknow (167), Cherat (161), Rangoon (148), and Quetta (146); those at which no case of simple continued fever was reported were Colaba, Wellington, Madras, Bellary, Thayetmyo, Deolali, Kuldanah, Kasauli, Neemuch, Dum Dum, Ahmedabad and Jutogh. For the European troops of India as a whole, the maximum seasonal prevalence during 1905 was from June to October and the minimum during the first three months of the year, and the same seasonal incidence is roughly applicable to each individual geographical group. The most frequent causes assigned for the attacks were excessive atmospheric heat, exposure to the sun without sufficient protection, chills, errors in diet and constipation.

The difference in the prevalence of simple continued fever at Mian Mir in 1904 and 1905 is said to be due to "different methods of diagnosis"; in the former year the microscope was utilised in the diagnosis of only 54 cases of fever as compared with 295 cases in 1905, the usual procedure now, apparently, being to return all cases of doubtful or obscure etiology (the microscopical examination of the blood, and possibly also Widal's reaction, being negative) under the heading of simple continued fever. From a station in Burma, which followed the same procedure in diagnosis, and returned 88 cases of simple continued fever it is reported that the fever was "easily controlled by hypodermic injections of quinine" and that characteristic symptoms of the illness thus recorded were headache, pain in limbs, constipation and a temperature ranging from 102° to 105° for a period of three to seven days. It must be borne in mind that inability to demonstrate the malarial parasite (unless after repeated examination of the blood by an expert) especially now-a-days when quinine prophylaxis is so general, is far from being absolute proof of the non-malarial origin of a fever; and further that even after the exclusion of malaria and enteric fever there are other continued fevers, *e.g.*, influenza, Malta fever, paratyphoid, &c., all endemic in India, which have to be considered in the differential diagnosis before a case is returned under the heading of simple continued fever. At Multan, for instance, some patients who on admission were placed under treatment for malaria were subsequently found to be suffering from Malta fever. The more extended use of the microscope for diagnostic purposes is doubtless largely responsible for the great increase of the reported prevalence of simple continued fever, and this must be taken into account in gauging the significance of the decrease of malarial fevers—intermittent and remittent.

Malta Fever.—There were ascribed to Malta fever four admissions with no deaths during 1905 against six admissions with three deaths in 1904, and nine admissions with no death in 1903. The reporting stations were Ferozepore (February), Quetta (May), Murree (May), and Rawalpindi (September); but the patient at Murree had been admitted from the line of march between Rawalpindi and Ghora Dhakka. The patient at Ferozepore was under treatment for syphilis when the disease developed. He had a total service of six years, four of which had been spent in India; he had never served in a Mediterranean station. The diagnosis was based on the absence of malarial parasites from the blood and the failure of large doses of quinine to reduce the temperature, on clinical grounds—muscular and articular pains and undulant character of the fever, and on the serum test (carried out at the Pasteur Institute, Kasauli) reported as positive for *M. melitensis* in dilutions of 1 in 160, and 1 in 320, and negative for *B. typhosus*. This patient, who was no doubt infected at Ferozepore, was subsequently transferred to Dalhousie. In the case of the patient at Quetta the diagnosis was made on clinical grounds combined with the history of his having served in Malta and having been previously invalided from there for Malta fever. It is not stated when this invaliding had taken place and whether any relapses had occurred in the interval. The blood reaction was not tested, but the clinical picture seems to have been fairly typical. The patient at Murree was most probably infected at Rawalpindi. He had never served in a Mediterranean station, but had been in South Africa. The diagnosis was arrived at on clinical grounds and on the blood reaction, carried out in the

Northern Command laboratory and reported to be "positive for *M. melitensis*, 1 in 50 dilution." The patient at Rawalpindi was at first admitted for malaria (malignant tertian) as the parasite was found in his blood and was treated by intramuscular injections of quinine. As this treatment had little effect on the temperature, which continued very irregular, the serum test with *B. typhosus* was carried out, but with a negative result. The liver also was explored twice with the same result. On the 37th day of illness, the blood tested in the Northern Command laboratory gave a "positive reaction for *M. melitensis* in a dilution of 1 in 200." During his stay in hospital he had a severe hæmorrhage from the bowel, stated to be from an ulcer on the anterior wall on a level with the prostate. Several of the characteristic symptoms and signs of Malta fever were present in this case, but the course of the fever, as presented on the temperature chart, was very irregular. It is not stated if he had served in a Mediterranean station.

Enteric Fever—Recent Investigations.—Taking a general survey of results obtained by a bacteriological examination of the blood, it must be acknowledged that for the early, rapid and comparatively easy diagnosis of typhoid, the method of blood-cultures bids fair to take the first place. Further advantages of this method are its special value in obscure cases and in differentiating typhoid from paratyphoid, also the fact that, *B. typhosus* having been isolated, the diagnosis is assured.

B. typhosus occurs in the urine in from 25 to 30 per cent. only of ordinary cases of typhoid, and is rarely found before the end of the second week, so the bacteriological examination of urine offers but little aid to the diagnosis of this disease. The possible danger, however, of infection from this source is to be borne in mind.

The hopes which had been entertained of the method of fæcal cultures for the diagnosis of typhoid have not apparently been realised. The method is laborious and yields but poor results compared with those of blood cultures.

The presence of typhoid bacilli in the gall-bladder, during convalescence from typhoid and subsequently, has of late received considerable attention.

B. typhosus is sometimes found in sputum in cases of typhoid fever. The sputum should be disinfected in all cases of typhoid fever.

It is evident from experiments that the longevity of *B. typhosus* depends more on actual contact with the sewage microbes than upon contact with by-products capable of diffusion through these membranes and that the duration of life of *B. typhosus* in water is materially affected by the germ contents of its surroundings. Exposed to water highly polluted with saprophytic bacteria, *e.g.*, sewage, the typhoid bacilli cannot survive more than a few days (three to five in the experiment), a period much shorter than that noted in natural unpolluted water. These results, which are said to have been remarkably uniform, strongly support the evidence which is gradually accumulating that *B. typhosus* is a short-lived organism in water under natural conditions.

The incriminating evidence against milk and other foods of spreading typhoid infection has hitherto almost invariably been indirect—by a process of excluding all other possible channels. Konradi, during a typhoid outbreak in the past year, has succeeded in isolating the typhoid bacillus (identified by the usual morphological and biological tests) from suspected milk. Although many epidemics are known to have arisen in this way, on only one previous occasion (in Chicago) has the bacillus been demonstrated in milk. Perhaps the commonest way by which the typhoid bacillus gets into milk is through the use of contaminated water for cleaning milk utensils or for adulteration purposes. Infection by milk can be effectually prevented by pasteurisation.

Although it is not proved that the typhoid bacillus cannot remain for years in earth and then enter the human body and cause enteric fever, the success of the German methods, which have as their sole object to destroy the specific virus as it leaves man, strongly supports the assumption underlying this working hypothesis—namely, that there is no other source of typhoid infection except man. If, as the exponents of these methods maintain, infection arose in other ways, *e.g.*, from soil to man, their efforts would have been futile. The specific virus is present chiefly in the fæces and urine of infected persons, but also to some extent in the vomit, sputum, saliva, nasal mucus, and sweat—practically in all secretions and excretions. Clothes, bedding, furniture, food, utensils, &c., soiled by these, can easily carry infection to others. Contact infection may be (1) immediate or direct, from the body of the

patient to that of attendants, or (2) mediate—through the medium of articles soiled by patients, *e.g.*, clothes, utensils, accoutrements, latrines, &c. In the latter case it is obvious that for contact infection to occur it is not necessary to live in the same room or barrack with or even to have seen or met a typhoid sufferer. Isolated cases separated by intervals of days or weeks, as opposed to the explosive outbreak from a common source of infection such as contaminated water or milk-supplies, are characteristic of infection by contact, where infection occurs in the series of cases at different times and in different ways. Contact infection, however, plays a part in all epidemics; in water-borne epidemics, after the explosive outbreak the contaminated water-supply is cut off, and thereafter all fresh cases of infection are due to contact. Schian, who was in medical charge of the German troops in South-West Africa, reports that segregation on the march or in camp was often impossible and typhoid infection was spread for the most part by contact; that disinfecting measures and particular attention to field latrines were most useful in combating the disease. In connection with typhoid in the United States' Volunteer encampments (1898), Childs states that personal infection, direct or indirect, especially from unrecognised and abortive cases was the chief factor in the spread of the disease. Similarly in the official report on the origin and spread of typhoid in the United States' camps in the Spanish war of 1898, it is held that water was not an important factor, that infected material was transported on the person, clothing and tents, and that infection by contact was all the more frequent as only about half the cases were correctly diagnosed by the army surgeons. For this reason it is strongly urged that all excreta should be disinfected and carted away to some distance from camps. In civil life, we find the same state of things.

Leaving aside occasional abortive and incorrectly diagnosed cases of infection, there are two classes of the public, viz., children and typhoid bacilli-carriers, that, owing to certain peculiarities in their reaction to the typhoid bacillus, are specially dangerous to the community. Children suffer from this disease usually in a mild form, incorrect diagnoses being very frequent, and both from their habits and from their being together in school or at play for a great part of the day are particularly liable to become infected themselves and to infect others; the incidence of the disease is greater among children than among adults. The greater liability of infection from children than from adults has been pointed out by Baginsky, who has studied the course of the disease, as it affects children between one and fourteen years of age, in 88 cases. Frequently the disease, appearing as a feverish dyspepsia, was not recognised. This fact, together with the greater liability of children to soil their surroundings, make it obvious that children are very apt to spread infection by contact. Whenever the floating alien population is increased in an endemic focus, *e.g.*, for public works or military operations, formidable epidemics are almost certain to occur. The peculiarities which make carriers specially dangerous to the public are the difficulty of detecting them, the length of time during which unknown to themselves or others they may be disseminating a virulent specific virus, our inability in the present state of our knowledge to free them from the specific virus and the practical difficulty, almost impossibility, of getting such carriers as are detected to remain under surveillance and bacteriological control and to carry out continuous and efficient disinfectant measures in order to prevent infection being conveyed to others.

Statements regarding the duration of life of *B. typhosus* outside the human body are most conflicting, some maintaining that the bacillus dies after a short period, others that it survives indefinitely. Although under exceptional conditions *B. typhosus* may for a time live, multiply and even gain in virulence, evidence is steadily accumulating that in soil as in water after a comparatively short space of time—especially when these conditions return to normal, virulence declines and the bacillus dies.

The typhoid bacillus is said by Heim to withstand drying for at least 213 days, so this possible method of infection must not be forgotten although infection in this way is probably much less frequent than supposed. In the official report on the spread of typhoid in the United States' camps in the Spanish war of 1898, the opinion is expressed that dissemination by dust was probable to some extent, the camping-grounds being grossly polluted, and that "flies undoubtedly served as carriers of infection." Similarly Childs from a study of the typhoid epidemics in the United States' volunteer encampments (1898) comes to the conclusion that there

was strong presumptive evidence to show that infection was spread to a considerable extent from the latrines by the hosts of flies which swarmed in many of the camps. As regards India, flies, although they do not appear to be the most significant factor in the spread of this disease in the majority of geographical groups, no doubt contribute their quota of cases of infection.

The first clear diagnosis of a case of paratyphoid fever, that is, of a bacterial septicæmia clinically like typhoid but associated with a bacillus quite distinct from Eberth's, was that of Gwyn in 1898, where a "paracolon" bacillus was cultivated from the blood of a patient with all the clinical features of typhoid fever.

In India, paratyphoid no doubt exists, and is possibly not infrequent; but in no case does the causative organism appear to have been isolated and identified. During the past year, a case which was almost certainly paratyphoid fever has been recorded by Major Morgan, R.A.M.C., at Lebong.

Enteric Fever.—Preventive Measures.—As the general and special measures usually adopted in the prevention and suppression of typhoid have been so fully discussed in previous numbers of this report, the following remarks will be confined for the most part to the subject as modified by researches referred to in the preceding paragraphs. It is now generally acknowledged that typhoid is spread by one of the following three ways: (1) contact, (2) water, (3) food (especially milk), and that there is little ground for fearing *B. typhosus* in our surroundings unless it has fallen into water or milk, when we may have mass-infection or epidemics. Water-borne epidemics arise from rivers, water-works or wells being contaminated; mass-infection by milk is relatively rare and is due usually to the milk-vessels having been washed with contaminated water, less frequently by the hands of the sick (especially ambulant cases), of carriers or of attendants on the sick conveying the bacillus into the milk. To stamp out water-borne and milk epidemics the same measures are required as for the prevention of infection by contact, viz., those which attack the virus as it leaves man. Infection by contact may be (1) immediate from the sick patient—especially if wrongly diagnosed, from the ambulant case or from the healthy bacillus-carrier; (2) mediate from articles contaminated by them. One frequently hears of intestinal typhoid, pneumotyphoid, nephrotyphoid, &c., but it must be borne in mind that typhoid is not a local infection of the intestine, lungs or kidneys but a bacillæmia and that the bacillus leaves the human body with all secretions and excretions although chiefly in urine and fæces. In fæces the bacilli are usually most numerous during convalescence and in both fæces and urine, although in their physical appearance there may be nothing to suggest infectivity, the bacilli may be excreted for years after convalescence. Other points to be remembered are that infection with *B. typhosus* may result in many atypical forms of illness which are liable to be wrongly diagnosed and have to be cleared up bacteriologically; that in children typhoid is not an infrequent disease, is usually of a mild type and therefore very often either wrongly diagnosed or left altogether without medical treatment (ambulant). Another interesting, if unusual, source of infection has been described by Dudgeon and Gray, and shows the importance of paying particular attention to bone lesions after typhoid. In this case an abscess appeared in a man's femur two years after an attack of typhoid and led to a sinus which discharged pus containing typhoid bacilli. The man usually dressed the sinus himself but his wife was in the habit of picking up the soiled dressings and burning them. The wife was infected and died of typhoid. It is obvious that proportionate with the increase in our knowledge of the etiology of typhoid has been the increase in magnitude of the difficulties to be faced in the campaign against the disease.

Prompt diagnosis is essential to success and the value of the method of blood cultures in this connection seems established. The agglutination test, however, is by no means to be laid aside although anomalous results occasionally occur. Even typhoid bacilli isolated from the spleen and blood of patients frequently show abnormalities—culturally and biologically as well as in agglutination, although these irregularities gradually disappear by successive passages through animals.

If we find ourselves face to face with an outbreak of typhoid our duty is to try and find the source of infection. Having first excluded the possibility of infection having been imported, attention is directed to water and food, which epidemiological evidence can as a rule easily incriminate or exonerate. If water

and food are free from suspicion, infection by contact alone remains, but still the exact source of infection may be far to seek. The most natural procedure now is to undertake a critical bacteriological examination of all suspicious cases of sickness in and out of hospital (in search of wrongly diagnosed and ambulant cases), paying particular attention to children; and, if no success attend such measures, final efforts must be directed to detecting chronic carriers among those who have at some time or another passed through an attack of typhoid. Here it may be well to draw attention to the fact that it is comparatively rare for carriers to excrete the bacillus in their urine especially when, as usually obtains among troops in India, convalescents from typhoid have undergone a thorough course of urotropine: *B. typhosus* is more likely to vegetate in the gall-bladder and vermiform appendix. Consequently, before convalescents from this disease are allowed to rejoin their regiments, their fæces rather than their urine should be examined bacteriologically several times after recovery at weekly intervals to determine whether or not they are capable of carrying infection. It has been shown that from two to four per cent. of typhoid patients become chronic carriers and Klinger, combining the four best methods of isolating the bacillus from fæces, successfully demonstrated the bacillus in only 80 per cent. of cases. The latter fact indicates not only the probability that the proportion of patients that become carriers is under-estimated but also the uncertainty of detecting by the best means at present in our possession *all* those convalescents who, by becoming carriers, remain constant foci of infection. A system of allowing men recovered from typhoid to rejoin their regiments after a course of urotropine is not sufficient to preclude the presence of carriers, who doubtless exist in all large stations in India;* and latrine disinfection and similar measures by no means safeguard *all* channels and eliminate the danger of infection from this source.

As it is impossible by present methods to detect all sources of infection, for the defence of the susceptible recourse must be had to anti-typhoid inoculation. Vaccines and bacterial extracts have increased in numbers during the past year but most of them are only on trial. Bassenge and Mayer inoculate with a germ-free filtrate of living cultures macerated in distilled water, and report that protection from one injection has lasted six months. Over 5,000 of the German troops going to South-West Africa were inoculated by Kolle and Pfeiffer's method, which consists in inoculating large doses, usually between the clavicle and nipple, in increasing amounts two or if possible three times at intervals of eight days.

Inoculation is, therefore, especially recommended by Morgenroth for soldiers on service in a country where sanitary measures against typhoid cannot be efficiently carried out. At the same time stress is laid on the importance of not sending the inoculated to an infected locality for at least three weeks after the second inoculation. Major Porter, R.A.M.C., has given the statistics of a regiment sent to this country where only two cases occurred amongst 200 inoculated but 60 among 400 non-inoculated. In its interim report the Anti-typhoid Inoculation Committee states that it is satisfied that "the records which are available up to date furnish proof that the practice of anti-typhoid inoculation in the army has resulted in a substantial reduction in the incidence and death-rate from enteric fever among the inoculated." The statistics available for 1904 show that the incidence of typhoid among the inoculated was reduced to at least half of that among the non-inoculated and a similar reduction was observed in the case-mortality of those who contracted the disease after inoculation compared with that among the non-inoculated.

Serum therapy has received a considerable amount of attention during the past year. The French were the first to show that it was possible to obtain an anti-endotoxic serum by injecting nothing but typhoid bacilli.

Enteric Fever: Opinions of medical officers.—Impossible as it has been in the vast majority of instances to ascertain the exact source of typhoid infection, station reports contain abundant evidence to show that so far as European troops in India are concerned water-borne epidemics of typhoid are rare. This doubtless is due in a great measure to the care bestowed on the water-supply in cantonments. There are as usual several isolated cases recorded where it is surmised that soldiers

* From the Central Research Institute, Kasauli, it is reported that two cases of enteric fever at that station were proved to be due to contact with a chronic bacillus-carrier.

have been infected by drinking water from way-side wells and similar sources while on the march, on manœuvres or on shooting expeditions, by drinking aërated waters in bazaars or bazaar milk which has possibly been adulterated with polluted water, or by eating bazaar fruits and vegetables which had been washed in impure water by the native vendors. The chief instance of infection in this manner was that of a draft of 23 men on the line of march to Fatehgarh. Shortly after arrival at that station 12 of these men were admitted to hospital for typhoid. Infection was considered to have been conveyed in the aërated water supplied by natives at one of the camps *en route*. Water of cantonments has been under suspicion in only two or three stations. At Rawalpindi it is said storage (now remedied) was bad, the water having been kept in open-mouthed earthenware *chatties* which were placed on the floor in verandahs; at Poona the water-supply, even after filtration, was regarded with suspicion and recommended to be boiled; at Ahmednagar *B. coli* was found in the soda water manufactured by a regiment. Apart from milk and other articles of food consumed in or brought from bazaars, the authorised supply of these articles (in canteens, coffee-shops, &c.) to regiments has been as a rule above suspicion. The chief exception was the milk-supply of two batteries at Rawalpindi. These two batteries, which had a common dairy in charge of a contractor who kept no cows himself but procured milk from native villages, furnished several cases of typhoid, while a third battery, occupying lines between the other two, had its own dairy under good management and remained free from the disease. At Aden the consumption of oysters taken from the harbour and sold by natives in the bazaar was held responsible for the infection of some men. In not a few stations (Peshawar, Rawalpindi, Quetta, Mhow, Meerut, Campbellpore, Jhansi and Bangalore) dust and flies have been put forward as possible factors in the spread, particularly as the proximity of latrines to cook-houses, stables to barracks, filth-trenches to cantonments, the dusty nature of the country and the small rainfall, favoured such means of dissemination. In Poona, however, dust was considered unimportant, because the greatest incidence was during the rains and the healthiest time of the year was during the dusty season.

One striking point brought out by a study of these station reports is the frequency of imported cases. Apparently most of the men admitted for typhoid in the hill-stations have been infected in stations in the plains or on their way to the hills. In the plains, also, importation is not an infrequent occurrence: 18 at Dinapore, 11 at Agra and 11 at Meerut contracted the disease outside their respective stations. In many stations (Peshawar, Quetta, Campbellpore, Mhow and Poona) typhoid is said to be endemic; in some of them the endemicity is attributed to the disease being prevalent amongst the native population, and the proximity of native villages and bazaars to cantonments and the constant intercourse between them are regarded as sources of danger to British troops. At Peshawar the prevalence of typhoid among natives was confirmed by Widal's reaction; from Sialkot the statement comes that typhoid was very prevalent among native children, but no evidence is given in support of this. In other stations, *e.g.*, Campbellpore, the source of infection was held to have been probably in the barracks themselves, although there had been no case of typhoid in the station so far as known for over 18 months before the outbreak: an opinion, however is not expressed regarding the manner in which the chain of infection had been sustained during that period. Of direct contact infection many instances are given. At Peshawar no less than seven hospital orderlies in attendance on typhoid patients were attacked; at Rawalpindi three nursing orderlies contracted the disease and they in their turn infected several others in their barrack room. Agra, Landour, Jullundur and Mian Mir also furnished cases of infection among attendants on typhoid patients: the hospital orderly who contracted the disease at Mian Mir was employed in the special ward nursing a case which was afterwards diagnosed as typhoid. At Bangalore the first typhoid patient among the troops contracted the disease in hospital where two officers were under treatment at the time suffering from severe attacks of the disease. The following instances explain to some extent the facility with which infection by contact, immediate or mediate, may take place. At Campbellpore when it appeared that an outbreak was inevitable, all the men of the recently arrived drafts were medically inspected. One man was found suffering from malaise and diarrhœa but not so ill as to report sick. He was admitted to hospital and kept under observation; a sample of his blood sent to the Sanitary Officer, Northern Command, for examination was reported as giving a positive

agglutination reaction in a dilution of 1 in 40 within half an hour with *B. typhosus*. This man had suffered from diarrhœa since his arrival in the station but had no fever. Subsequently, he became seriously ill and died after ten days' illness. At the *post mortem* examination healed enteric ulcers were found in the ileum, and the whole intestinal tract was congested. The medical officer of Campbellpore considers it probable that this ambulatory case of typhoid was the origin of the epidemic at that station. At Peshawar it was observed that in many cases symptoms were very slight and the men did not seem very ill although the serum reaction was quite distinct, and that frequently men did not come to the hospital for some days after feeling unwell. Such cases, it is pointed out, are powerful agents in spreading infection. The first man that was attacked by typhoid in the regiment which suffered most severely during the epidemic at Peshawar was ill eight days before coming to hospital and his admission was quickly followed by others from the same and neighbouring barrack rooms. At Cherat there was a well-marked connection between the first typhoid patient, who was ill for some days before coming to hospital, and the next three men admitted. At Karachi, one soldier had been going about for weeks before he reported sick and when admitted to hospital was at first considered to be suffering from ague: he subsequently had a relapse and died. Similar cases were reported from Delhi, Sialkot, Kasauli, Mhow, &c. Ambulant, abortive and atypical forms of typhoid infection are, therefore, not infrequent in India, and men suffering from these types of infection are a real danger to their comrades. At Rawalpindi the arrival of convalescents from the Murree hills was followed by a distinct increase in the number of admissions for typhoid. This led to a careful examination of convalescents with the result that *B. typhosus* was isolated from the urine of several of them. A man, who had been in hospital at Jhansi for some weeks on account of simple continued fever, was sent to Naini Tal for a change. As the history of the case raised suspicions, he was, on arrival at Naini Tal, admitted to hospital for debility, treated with urotropine, kept under observation for 16 days, and then segregated with the other typhoid convalescents. Five weeks after arrival he complained of abdominal discomfort and was admitted to hospital. He had a typical relapse; Widal's reaction was positive. The medical officer at Naini Tal states that he considers all convalescents from simple continued fever arriving from the plains as suspicious if fever had been present for more than two or three days, and that he treats all such cases as typhoid convalescents. Cases like this show the importance, nay, the necessity of viewing all cases of fever as possibly enteric until that disease can be definitely excluded from the diagnosis.

Latrine infection takes a prominent place in many reports. At Peshawar a group of bungalows with their latrines were regarded as infected and on the removal of the troops from this infected area to other barracks the disease ceased: the latrines were of a bad type and situated too near the cook-houses and barracks; the dry-earth system was in vogue and soldiers often omitted to cover their excreta with earth; and flies and dust were plentiful. At Mian Mir infection was considered to have been spread by contact, especially through the medium of infected clothing, bedding and soiled latrine seats: barracks were evacuated; contacts put under canvas, provided with separate latrines and urinals, and their excreta boiled; and clothing, bedding, &c., as well as the evacuated barracks and latrines were disinfected: these measures were followed by good results. At Bangalore the 6th Dragoon Guards were particularly affected, and the only sanitary defect that could be discovered was the proximity of latrines to cook-houses. Barracks and latrines being regarded as infected, the regiment was put under canvas for one month and the vacated barracks and latrines were disinfected. While under canvas there was not a single case of infection, but a couple of weeks after return to barracks the disease broke out again and spread rapidly. The permanent latrines were, therefore, closed and temporary ones constructed on the opposite side of barracks, so as to be as far away from cook-houses as possible, and all excreta were mixed with carbolic acid and boiled. During the six weeks of the year remaining after the adoption of these measures only one man was admitted to hospital for typhoid. In Meerut and Mhow good results seem to have followed the use in latrines of a two per cent. solution of crude carbolic acid instead of dry earth. The following case reported from Naini Tal is of interest. One man had suffered from a severe attack of typhoid at Agra and after being in hospital there for 117 days was sent for a change to Naini Tal where two weeks after arrival he had a relapse.

In most stations diagnosis was confirmed by Widal's test; but in only two stations, apparently, has an attempt been made to isolate the *B. typhosus*. At Sialkot the method of blood cultures was tried in several cases with considerable success; at Karachi bacteriological examinations of blood, urine and fæces were made in each case, but the results are not stated. At Lebong there were only three cases of "typhoid" reported during the year and the three men happened to be in hospital at the same time. Two of these were imported cases; the third case was that of a man who had had no connection with the other two, came from a quite separate part of barracks and had evidently been infected in the station. Widal's test was carried out simultaneously for three patients who were all suffering from a disease clinically resembling typhoid. The blood serum of the two patients who imported the disease agglutinated *B. typhosus* in all dilutions made, while the serum of the locally infected patient entirely failed to agglutinate *B. typhosus*, but agglutinated *B. enteritidis* (Gärtner) in all dilutions in which the test was carried out. This case, which the medical officer regards as one of paratyphoid, would have been of much greater interest and value had the specific organism been isolated and the exact type of paratyphoid bacillus established. In connection with the possible occasional association of paratyphoid with domestic animals, it is worthy of note that at Ambala a strict limit has been placed on the number of dogs, poultry and pigeons kept in barracks.

Enteric Fever: Special sanitary investigations.—Besides an account of inspections and routine laboratory work chiefly concerned with microscopical, bacteriological and chemical examinations, the reports of the Sanitary Officers of Commands for the year 1905 contained the results of investigations of the origin of special outbreaks of enteric fever and other epidemic diseases. For the Northern Command, Major Scott, R.A.M.C., made a special investigation of the typhoid epidemics at Peshawar and Campbellpore. At Peshawar, food and water-supplies were exonerated from all blame: the continuance of the epidemic was regarded as due to "latrine infection, using the term in its broadest sense." The affected bungalows were all in one group, with the latrines not far distant and too near the kitchens. Infection quickly became general in these bungalows because latrines were so placed in relation to bungalows that the latrine which a man from any particular bungalow used depended on which side of the bungalow he emerged, the nearest latrine being invariably the one to which he resorted. The evacuation of this group of bungalows, the thorough disinfection of latrines and the use of crude carbolic acid (three per cent.) instead of dry earth for pans, &c., soon checked the epidemic. Between the first four cases at Campbellpore there was probably a personal connection as all four had supper together on the night prior to the departure of one of the four for Multan. Reasoning by a process of exclusion, the Sanitary Officer comes to the conclusion that here again latrine infection was the cause of the spread, and this conclusion is supported by the later history of the outbreak; for, with the exception of a few ordinary sanitary recommendations for the station in general, measures were restricted to disinfection of latrines and bungalows, and the disease immediately ceased. Two cases are specially mentioned to show the extreme difficulty of determining the immediate cause of an outbreak of typhoid in this country. The first was that of a Gunner who was found to be excreting *B. typhosus* in his urine six months after his discharge from hospital. After a course of urotropine, further attempts to isolate this bacillus from the urine proved futile. The second case occurred at Campbellpore and was an example of the ambulant form of typhoid. The report of Major Elliott, R.A.M.C., the Sanitary Officer of the Western Command, deals specially with the outbreaks of enteric fever at Ahmedabad, Mhow and Poona. At Ahmedabad the source of infection was traced to contaminated mineral waters sold in the bazaar. Samples of the suspected water were analysed and found to contain *B. coli* and *B. enteritidis sporogenes*. The use of waters from this source was discontinued and the outbreak promptly terminated. This epidemic is the only one attributed to contaminated water, which has occurred in the Command during the past five years, the usual method of spread being, in the opinion of the Sanitary Officer, contamination of food by dust and flies which carry the virus from polluted soil. At Mhow all cases had their origin in the station; all seem to have arisen independently, and there was no epidemic prevalence. Typhoid is endemic in this station and consequently latrines, urinals and their vicinity were regarded as probably infected. The dry-earth system of conservancy was discontinued and carbolic acid extensively used: the provision of

a high pressure steam disinfector for use at the station hospital was recommended. The prevalence of typhoid at Poona was due, in the opinion of Major Elliott, not to causes within regimental lines but to the insanitary condition of their surroundings. Typhoid is said to have been frequent among the natives and also among the civil population of the cantonment. No care was taken to disinfect the excreta of such cases and the night-soil carts from the bazaar and other places passed near or through regimental lines and by droppings specifically fouled the roads. Dust and flies were abundant during the year and were regarded as the carriers of infection. Major Aldridge, R.A.M.C., in the report for the Eastern Command draws attention to the difficulty of differentiating species of bacteria which are of intestinal origin from those which are not. In waters there are *coli-like* bacilli, not necessarily of intestinal origin, which, if reliance be placed on the usual tests, may be mistaken for *B. coli*. Similarly, there appear to be several species of bacilli which, if the milk reaction alone be relied on, might be wrongly identified as *B. enteritidis sporogenes*. It is pointed out that "coincidently with the late winter, the usual spring exacerbations of enteric fever were delayed about a month at most stations in the Eastern Command" and that the enteric seasons correspond with the periods of greatest prevalence of flies. At Lucknow special observations were made on the number of flies in barracks, kitchens, latrines and filth trenches and the increase of flies during the latter part of March corresponded very closely, allowing for the incubation period, with the commencement of enteric fever. The total number of flies was undoubtedly less than usual, and, while those found in the lines were mostly common house flies (*Musca domestica determinata*), the only species bred from larvæ and pupæ taken from trenches belonged to the genera *Hylemyia* and *Ulidia*. Apparently, therefore, for some reasons at present unknown, the trenching grounds during the first half of the year were not furnishing the enormous number of flies they usually do and, coincidently, the admissions for typhoid were less than half the corresponding average for the last eight years. Outbreaks of enteric fever at Meerut and Dehra Dun were specially investigated. Stress is laid on two factors which under favourable climatic conditions seem to determine the prevalence of enteric fever among British troops in India: (1) a community peculiarly susceptible on account of age, and (2) a system of sewage removal and disposal eminently suited to the dissemination of *B. typhosus*. In both stations, measures directed against the spread of infection by latrines and clothing were attended with success. The report contains an interesting account of an outbreak of peripheral neuritis, regarded at the time as beri-beri, among British troops at Cawnpore. Although the symptoms were compatible with the supposition that the disease was beri-beri, it was difficult to reconcile many facts with this view. The only other satisfactory explanation of such symptoms occurring in epidemic form seemed to be that they were due to chronic arsenical poisoning and this hypothesis is supported by the facts that a considerable quantity of arsenic was found in the hair of one patient and a trace in the urine of two others, and that all the men attacked were beer-drinkers. On the other hand, no arsenic could be detected in the beer or other articles of food and drink. Samples of the beer that was being issued at the time of the epidemic were, however, not available (the special investigation of the epidemic having taken place some time after the actual outbreak), so the result of the analysis of the beer which happened to be in stock after the epidemic had ceased detracts little from the assumption that the epidemic was one of chronic arsenical poisoning.

Enteric Fever in 1905.—The prevalence of enteric fever among European troops in India during 1905 may now be briefly noted. There were 1,146 admissions and 213 deaths during the year as compared with 1,395 admissions and 267 deaths in 1904 and 1,384 admissions and 293 deaths in 1903. The admission-rate per mille of strength was 16·1 against 19·6 in the previous year. The average duration of a case in 1905 was about 70 days, in 1904 about 68 days, and in 1903 about 54 days. This progressive increase, year after year, in the stay of a typhoid patient in hospital is doubtless due to a more thorough appreciation by medical officers of the danger which convalescents from this disease are to their comrades, if permitted to return to barracks without undergoing a prolonged course of urotropine. That freeing the urinary system thus from typhoid bacilli is not sufficient and does not necessarily completely disinfect the convalescent has been demonstrated. The average number of men constantly sick was 220·50 and the total loss of service due to enteric fever alone was 80,482 days against a constantly sick rate of 256·20 and a loss of 93,769

days in 1904. The death-rate fell from 4·19 per mille in 1903 and 3·76 in 1904 to 2·99 in 1905. The case-mortality is slightly lower than that of the previous year: among every 1,000 patients five more recovered during 1905 than during 1904 and 26 more than during 1903.

There is every reason for believing that this satisfactory improvement is due to the prophylactic measures now in force, in particular those measures which have as their object the limitation of infection by contact, *e.g.*, the segregation of newly arrived drafts and regiments, the early diagnosis and isolation of cases of enteric fever, the attempts to disinfect those who are convalescent from this disease and the disinfection of latrines, barracks, and clothing which may possibly have been contaminated. Much still remains to be done in the way of discovering mild ambulant cases, of recognising atypical forms of the disease and of detecting those convalescents who become carriers in spite of the most thorough administration of urotropine.

Enteric Fever in Commands and Geographical Groups.—The disease was equally prevalent in the three commands but was rather more fatal in the Western than in either of the other two commands. As regards divisions, the incidence was greatest among troops in the 1st (Peshawar), the 6th (Poona) and the 2nd (Rawalpindi) Divisions and least among troops in the 10th (Burma) Division. Of geographical groups, Deccan (IX), Upper Sub-Himalaya (VI), and Indus Valley and Frontier (VII) showed the greatest prevalence during 1905 and of these Deccan (IX) and Upper Sub-Himalaya (VI) always occupy an unenviable position in this respect. On the other hand, the admission-rates in Gangetic Plain (V) and Central India (VIII), which have a very bad record for enteric fever, were only about half those of 1904 or the corresponding decennial means. Hill Stations (XIIa) show a progressive improvement, the admission-rate which was 29·4 per mille for the decennium 1894-1903 having fallen to 14·7 in 1904 and 10·9 in 1905. Burma Coast (I) and Western Coast (X) together did not furnish more than 1·1 cases per mille of strength. The following tabular statement, of the monthly incidence, based on the total admissions during the past ten years, in the geographical groups throws a little light on the possible part which dust and flies play in the dissemination of enteric fever in the different groups.

Seasonal incidence of Enteric Fever in Geographical Groups during the Decennium, 1896–1905.

Geographical Groups: 1. Actual Numbers of Admissions ... ... 2. Mean (Monthly) Admission Ratios per 1,000 of Strength ... ... during the decennium 1896–1905.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total numbers of admissions and average annual admission ratios during the decennium 1896–1905.
I.—Burma Coast and Bay Islands.	8	1	4	7	4	13	26	10	4	5	4	3	89
	·7	·1	·3	·6	·4	1·1	2·3	·9	·4	·5	·4	·3	7·8
II.—Burma Inland ...	6	6	8	4	6	8	16	9	7	3	13	2	88
	·3	·3	·4	·2	·3	·3	·6	·4	·3	·1	·6	·1	3·8
IV.—Bengal and Orissa ...	9	28	22	32	10	27	25	18	13	9	11	5	209
	·4	·12	1·1	1·6	·5	1·3	1·2	·9	·7	·5	·6	·2	10·2
V.—Gangetic Plain and Chutia Nagpur.	157	98	217	304	210	71	48	131	108	97	170	180	1,791
	2·4	1·4	3·1	4·6	3·3	1·1	·7	2·0	1·6	1·5	2·5	2·8	27·1
VI.—Upper Sub-Himalaya	246	113	161	395	555	329	133	190	137	139	293	432	3,123
	1·6	·7	1·0	3·1	5·5	3·4	1·4	2·0	1·4	1·2	1·9	2·7	24·5
VII.—North-West Frontier, Indus Valley and North-West Rajputana.	53	35	53	92	94	135	95	36	36	43	70	61	803
	1·0	·6	1·0	1·7	2·3	3·4	2·5	·9	·9	·9	1·3	1·1	16·9
VIII.—South-East Rajputana, Central India and Gujarat	140	85	166	358	200	62	99	217	249	129	105	150	1,960
	2·4	1·4	2·7	5·8	3·3	1·0	1·7	3·6	4·2	2·2	1·8	2·7	33·0
IX.—Deccan	77	74	140	156	154	121	202	397	353	173	105	58	2,010
	·8	·8	1·5	1·6	1·6	1·3	2·1	4·2	3·8	1·8	1·1	·6	21·3
X.—Western Coast	5	5	12	9	6	8	12	7	9	4	5	3	85
	·3	·3	·7	·6	·4	·5	·8	·5	·6	·2	·3	·2	5·4
XI.—Southern India ...	25	48	57	45	29	53	65	64	30	37	37	35	525
	·8	1·4	1·8	1·4	·9	1·7	2·0	1·9	·9	1·1	1·1	1·0	16·0
XII. (*a*)—Hill Stations ...	15	6	89	293	340	285	326	321	326	196	147	17	2,361
	·5	·2	1·8	3·1	2·4	1·9	2·2	2·3	2·4	2·1	3·6	·5	26·2
XII. (*b*)—Hill Convalescent Depôts and Sanitaria.	1	1	23	125	108	87	47	47	30	25	16	4	511
	·1	·1	1·2	3·0	2·0	1·6	·9	·9	·6	·7	1·1	·1	15·2
INDIA	843	591	1,030	1,879	1,800	1,286	1,173	1,512	1,389	912	1,092	1,076	14,582
	1·3	·9	1·5	2·8	2·6	1·9	1·7	2·2	2·1	1·4	1·6	1·6	21·8

If dust is a very significant factor in the spread of the disease, the incidence should be relatively low during the rains. Applying this test to the different geographical groups we find that dust can be a possible factor of *significant* importance in only four groups: Gangetic Plain (V), Upper Sub-Himalaya (VI), Indus Valley and Frontier (VII), and Convalescent Depôts (XII-*b*): in the first two groups (V and VI), however, where there was a decided increase of incidence during August, dust cannot by any means be the only possible significant factor. As regards flies, it is difficult in so extensive a country as India, which includes regions with vastly different climates, to lay down general tests relative to the prevalence of flies, about the life-history of which we have still much to learn. Precise information (obtained from observations extending over several years) on the relative monthly prevalence of these insects in the stations of India would be of great help in gauging the importance of flies in the dissemination of typhoid. In the present state of our knowledge the easiest test to apply is a comparison of the relative frequency of admissions for enteric fever in the two seasons of the year when flies are (1) most common and (2) least common. Flies are numerous everywhere in the months of August and September, and probably in most stations they are more numerous then than in any other two months, but it is only in groups VIII, IX, XI, and XIIa that the incidence of enteric fever is relatively heavy during these months: in one group (viz., VII) the incidence of enteric fever is lowest in these months and February. Flies are

Seasonal incidence of Enteric Fever during the Decennium 1896–1905, *in stations in the Northern Command and in seven other Indian stations in which the disease is very prevalent.*

Stations.	1. Actual Numbers of Admissions ... ... 2. Mean (Monthly) Admission Ratios per 1,000 of Strength ... ... during the Decennium 1896–1905.												Total numbers of admissions and average annual admission ratios during the decennium 1896–1905.
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	
Peshawar	44	19	28	40	44	94	85	20	26	27	58	42	527
	2·1	·9	1·3	2·0	3·5	8·1	7·4	1·7	2·1	1·6	2·9	2·1	31·9
Nowshera	3	1	1	10	22	25	7	7	3	6	1	5	91
	·4	·1	·1	1·3	3·8	4·8	1·6	1·6	·7	1·0	·1	·6	14·2
Rawalpindi	41	15	12	78	120	115	49	50	41	33	47	95	696
	1·1	·4	·3	2·4	7·0	7·6	3·3	3·3	2·6	1·5	1·3	2·5	26·0
Campbellpore	—	—	—	5	35	22	1	1	2	12	1	1	80
	—	—	—	1·9	13·5	8·6	·4	·4	·8	4·8	·4	·4	32·7
Sialkot	15	—	4	13	44	38	9	8	6	12	18	18	185
	1·2	—	·3	1·0	4·6	4·1	1·0	·9	·7	1·2	1·6	1·7	17·3
Mian Mir	12	16	14	17	35	23	18	7	8	4	12	20	186
	1·3	1·7	1·3	2·0	5·0	3·3	2·7	1·1	1·3	·6	1·2	2·1	23·0
Fort Lahore	3	4	1	6	3	3	1	3	—	1	6	5	36
	2·8	3·8	·9	5·8	2·9	3·0	1·0	3·0	—	1·1	5·8	4·6	34·8
Dalhousie	—	—	—	53	50	16	9	10	7	2	3	—	150
	—	—	—	6·6	3·5	1·0	·6	·7	·5	·2	3·2	—	19·0
Multan	1	2	6	29	21	11	1	3	3	8	5	4	94
	·1	·2	·5	3·1	2·7	1·5	·1	·4	·4	1·0	·5	·4	10·4
Ferozepore	5	5	4	31	40	9	8	8	5	5	5	11	136
	·5	·5	·4	3·1	4·8	1·1	1·0	1·0	·6	·6	·5	1·2	14·7
Jullundur	5	1	11	22	32	14	3	8	3	4	4	12	119
	·6	·1	1·1	3·0	5·6	2·6	·6	1·6	·6	·7	·5	1·8	17·8
Ambala	87	31	50	55	76	27	11	22	18	17	95	146	635
	3·3	1·1	1·8	4·0	6·5	2·3	1·0	1·9	1·5	1·1	3·4	5·2	33·6
Kasauli	—	—	6	26	12	19	5	11	5	3	2	—	89
	—	—	3·0	4·6	1·9	2·8	·8	1·8	·9	·9	3·1	—	24·3
Dagshai	1	—	2	38	29	42	38	15	6	1	1	1	174
	·5	—	·8	5·0	3·3	4·6	4·2	1·8	·8	·2	·5	·5	31·1
Subathu	—	—	8	51	38	21	24	36	44	4	—	—	226
	—	—	5·6	8·4	5·3	2·9	3·3	5·1	6·7	·8	—	—	52·8
Quetta	13	—	6	8	10	63	108	157	170	163	139	15	852
	·6	—	·3	·3	·4	2·5	4·2	6·2	6·7	6·7	5·8	·6	35·4
Mhow	44	30	36	104	52	30	79	74	47	18	17	36	567
	2·6	1·8	2·1	6·4	3·3	1·9	4·9	4·6	2·9	1·1	1·1	2·3	35·3
Meerut	46	24	42	111	103	50	19	51	31	31	73	80	661
	2·4	1·0	2·1	6·9	6·6	3·3	1·2	3·3	2·0	1·9	3·5	3·8	37·0
Lucknow	95	45	102	149	99	41	20	52	48	46	83	100	880
	4·0	1·8	4·2	6·6	4·5	1·8	·9	2·3	2·1	2·0	3·3	4·1	37·9
Poona	12	9	23	16	7	9	30	148	142	49	13	8	466
	·6	·4	1·2	·8	·4	·4	1·4	7·1	6·8	2·3	6·3	·4	22·7
Secunderabad	28	28	41	26	37	32	71	111	94	66	4·2	20	596
	1·0	1·0	1·5	1·0	1·5	1·3	2·8	4·4	3·8	2·4	1·5	·7	22·4
Bangalore	18	35	48	29	24	47	57	59	22	31	16	24	410
	1·1	2·0	2·8	1·8	1·5	2·9	3·4	3·5	1·3	1·8	1·0	1·4	24·4

not specially numerous in Northern India in the winter, and yet in group VII (North-West Frontier and Indus Valley) the incidence of enteric fever then is comparatively high. From the table on page 49 it will be observed that the winter incidence of this disease in the most northerly Indian stations is far from being insignificant. The same table also shows the seasonal incidence in seven other Indian stations, outside the Northern Command, which generally suffer severely from this scourge. It is hoped that the figures given may be of some assistance to officers in medical charge of these stations in forming an opinion on the extent to which the seasons of greatest prevalence of flies coincide with those of heaviest incidence of enteric fever.

Enteric Fever in Stations.—From 25 stations as against 28 in 1904 admission-rates of over 20 per mille were reported and among these the following may be noted with their admission-rates per mille:—

In Group VI.		In Group V.		In Group VIII.		In Group IX.	
Campbellpore	190·3	Fatehgarh	89·2	Indore	44·1	Poona	43·2
Meerut	57·3	Dinapore	32·8	Nowgong	28·0	Secunderabad	27·3
Lahore	49·6	Lucknow	27·8	Jhansi	26·8	Kirkee	24·0
Amritsar	24·5			Mhow	23·0		
Rawalpindi	23·9						
Mian Mir	22·1						
Ferozepore	20·2						

The list also includes Peshawar (4·27), Barrackpore (21·0), and Quetta (20·5), as well as five hill-stations and convalescent depôts. There was a total absence of enteric fever from 20 stations, including Pachmarhi, where in 1904 there were 24 admissions and four deaths among 162 men. All stations in group (VIII) Central India show a decrease (compared with last year's figures) except Indore and Nowgong, and, similarly, all stations in group (V) Gangetic Plain, except Fatehgarh and Allahabad. The monthly incidence of enteric fever among European troops shows how rarely a sudden outburst, so characteristic of an epidemic due to infected water or food, occurs in Indian stations; the evidence is strongly suggestive of "contact infection."

Relation of Enteric Fever to Age and Length of Residence in India.—In 1905 as in previous years the greatest liability to suffer and die from enteric fever fell upon the age-period 20 to 25 and upon the first year of Indian service. The extent of this liability is indicated by the fact that nearly 73 per cent. of the total admissions at all ages were among men up to 25 years of age and that nearly 64 per cent. of the total admissions were among men during their first two years of Indian service. The tendency to a rise in the admission rates for the higher age-period continues: in 1905 the admission-rate of men over 35 years of age was 4·2 per mille as compared with 4·0 in 1904 and 3·5 in 1903. On the other hand, there has been a break in the progressive rise of the admission-rate for the higher service-periods: the admission-rate during 1905 of men with five years' service and upwards was 6·9 per mille as compared with 11·4 in 1904 and 10·2 in 1903.

Plague and some other General Diseases.—Among European troops in India in 1905 there were recorded 13 cases of plague with four deaths as compared with two cases with no fatality in 1904 and 12 cases with two deaths in 1903. Of the 13 cases reported during 1905, seven cases with two deaths were at Aden, three with one death at Bombay, one (fatal) at Benares, and one case each at Fatehgarh and Port Blair. At Aden all seven cases occurred between the 19th and 24th April, the source of infection having been traced to the regimental coffee-shop which was infested with plague-stricken rats. The town, in which the disease was prevalent, had been out of bounds for two months before the outbreak among the troops. At Bombay the exact source of infection was not ascertained, but the disease was prevalent among the natives in the town. The patient at Benares was probably infected in the *Sadar* bazaar which suffered severely from plague and was separated from barracks by a road only. The medical officer at Fatehgarh suggests that the patient at that station was infected by his favourite cat which was known to have killed rats in the infected quarters of hospital servants. The case at Port Blair was imported from Rangoon. There were altogether 13 admissions with one death on

account of measles, the majority occurring at Quetta and Lucknow. Erysipelas accounted for 36 cases with three deaths. Of the 46 admissions with five deaths on account of beri-beri, no less than 25 with three deaths were recorded at Aden and 10 with one death at Cawnpore. The outbreak at Cawnpore, which occurred between August and October, has already been referred to. At Aden the disease is said to have been unknown among British troops in that station until the arrival of a regiment from Burma about six years ago. The incidence is said to have been high among beer-drinkers but no trace of arsenic was detected on analysis of the beer. The patients were between 24 and 36 years of age and about half of them lived in the upper stories of barracks and about half in the lower. The spread of the disease is attributed to infected buildings under the favouring conditions of heat and moisture. (The native troops at Aden furnished one case of beri-beri.) There were 415 cases of dengue with one death as compared with 439 cases with one death in 1904 and 303 with one death in 1903. The disease was practically confined to two stations in the Secunderabad Division and two in the Burma Division, Fort St. George (Madras) with 48 cases and Rangoon with 354 cases being the chief places affected. At Rangoon no case of dengue was recorded from January to May: most cases occurred in November. In 1902 the epidemic at Rangoon lasted from March to July, so the seasonal incidence varies considerably. With regard to the cases reported in December, the medical officer states that the diagnosis is open to question as the main clinical features of dengue were absent. The blood of a large number of these was carefully examined for malarial parasites but with negative results. *Bilharzia hæmatobia* accounted for 22 admissions during the year against 63 in 1904 and 318 in 1903. The number of stations in which a case or cases were detected was 11 as compared with 26 in the previous year and 33 in 1903. The number of men invalided for this cause fell from 71 in 1904 to 23 during the year under report.

Tubercle of the Lungs.—The admission-rate of European troops in India on account of tubercle of the lungs fell from 2·8 per mille in 1904 to 2·1 in 1905. The admission-rate of the Western Command (3·0) has increased while those of the Eastern and Northern Commands have decreased, that of the Northern Command (1·7) being less than half what it was in the previous year. The stations reporting the largest number of admissions were Poona with 14, Rangoon with 10, Quetta with 9, and Lucknow with 8. The death-rate fell from ·38 in 1904 to ·28 per mille during 1905, and the number of men invalided for this disease from 223 to 116. The death-rates from tubercle of the lungs of European troops, native troops, and prisoners during the year were in the proportion of 5, 9 and 65, respectively, as compared with 5, 7 and 48, respectively, in 1904.

Pneumonia and other Respiratory Diseases.—In 1905 the admission and death-rates for pneumonia were 4·1 and ·63 per mille, respectively, as compared with 3·4 and ·52 in 1904, the corresponding decennial means being 4·3 and ·62, respectively. There were 296 admissions and 45 deaths from this disease in 1905 against 240 and 37 in 1904. Both admission and death-rates were greatest in the Northern Command and least in the Eastern. The three groups in which pneumonia is usually most prevalent among European troops are (VII) Indus Valley and Frontier, (VI) Upper Sub-Himalaya, and (XIIa) Hill Stations, and in 1905 these same three groups head the list with admission-rates of 7·1, 5·4, and 5·8 per mille, respectively, (IV) Bengal-Orissa coming next with 4·7, and (VIII) Central India next with 4·4. Compared with the previous year there was an increase in the admission-rate in all the geographical groups except (I) Burma Coast, (XI) Southern India, and (XIIb) Convalescent Depôts, and the increase was greatest in (IV) Bengal-Orissa and (VII) Upper Sub-Himalaya. Excluding Fort Lahore and Khandalla where the strength was low, the highest admission-rates for the year were recorded at Dum Dum with a rate of 17·8 per mille and an average strength of 281 men, Quetta with 13·1 and a strength of 2,590 men, Nowshera with 12·5 and a strength of 720 men, Ambala with 11·7 and a strength of 2,314 men, Agra with 10·5 and a strength of 1,146 men, and Peshawar and Thayetmyo each with 10·2 and strengths of 1,663 and 488, respectively. For India as a whole the months of greatest prevalence are, as a general rule, December, January, and February, and those of least prevalence July, August, and September; for the year under report most cases occurred in December and fewest in July.

There was an increase in the admission-rate on account of "other respiratory diseases" as compared with the previous year, viz., 23·0 per mille against 21·4 but the death-rate was only ·06 per mille as compared with ·10. The increase in the admission-rate is shared by all three commands, but the greatest rise was in the Eastern Command where the rate rose from 17·3 to 22·5. The highest rate (26·4) was in the Western Command. The geographical group in which these diseases were most frequent during the year was (IV) Bengal-Orissa, (XIIb) Convalescent Depôts coming next; and the stations (excluding those with an average strength below 150) which recorded admission-rates above 40 per mille were Dum Dum, Quetta, Wellington, Kuldana, Karachi, Kasauli, and Maymyo.

Dysentery and Diarrhœa.—There has been a slight increase in both the admission and death rates on account of dysentery, the rates being 13·4 and ·46 per mille as compared with 12·6 and ·42 in 1904. Native troops show a slight increase in the admission-rate, but a decrease in the death-rate; while, as regards prisoners, there was a decrease in the admission rate, but an increase in the death-rate. Of the three Commands the disease was most prevalent and fatal during the year among European troops in the Western and, as regards Divisions, it was most prevalent in the 9th (Secunderabad), 4th (Quetta), and 5th (Mhow). The death-rates were highest among troops in the 10th (Burma) and 5th (Mhow) Divisions. Among geographical groups, the disease was most prevalent and fatal in (I) Burma Coast. Excluding stations with a strength below 150, the highest admission-rates were recorded at Dthalla (Aden Hinterland) with a rate of 65·9 per mille among 349 men, Barrackpore with 55·9 among 286 men, Rangoon with 40·2 among 1,119 men, and Aden with 33·8 among 947 men. For the European Army as a whole the months of greatest prevalence were July, August, and September, and those of least prevalence February and March.

While dysentery was the cause of 959 admissions and 33 deaths, diarrhœa accounted for 1,087 admissions with no fatality. The admission-rate for diarrhœa was 15·2 per mille as compared with 13·1 in the previous year. The disease was most prevalent in the Eastern Command, and least in the Northern. As regards geographical groups, the highest rates were in (XII *a*) Hill Stations, (I) Burma Coast, and (IV) Bengal-Orissa. In the first mentioned are included the two stations with the highest ratios, *viz.*, Ranikhet (108·6 per mille) and Lebong (49·4), as well as Dagshai and Chaubattia, which have ratios of 42·2 and 33·8 respectively.

Hepatic Abscess.—The admission and death-rates on account of abscess of the liver were 2·1 and 1·18 per mille as compared with 2·6 and 1·36 in 1904. In the Northern Command the admission-rate was only about half, and the death-rate only about a quarter of the corresponding rates in either the Western or Eastern. The disease was most prevalent among troops in the 6th (Poona), 8th (Lucknow), 5th (Mhow), and 9th (Secunderabad) Divisions, and the Aden Brigade. The death-rates were highest in the Aden Brigade and 5th (Mhow), 8th (Lucknow), and 9th (Secunderabad) Divisions. As regards geographical groups (IV) Bengal-Orissa still retains an evil reputation, which during the year under report is shared with (X) Western Coast, (XII *b*) Convalescent Depôts and (IX) Deccan. There were in all 153 admissions with 84 deaths recorded during 1905 as compared with 185 admissions and 97 deaths in the previous year. One or more cases were reported from 60 stations, and, excluding Poonamallee and Calicut, where the average strength was low, the highest admission-rates were at Barrackpore (three cases with one death), Dinapore (five cases with four deaths), and Kasauli (three cases with two deaths). At Lucknow, however, there were thirteen admissions with five deaths, at Poona eleven admissions with two deaths, at Secunderabad seven admissions with five deaths, at Wellington six admissions with four deaths, and at Jhansi five admissions with four deaths, these being stations with an average strength of about 1,000 and over. There was a history of dysentery in eight of the thirteen cases at Lucknow, in four of the seven cases at Secunderabad, in two of the eleven cases at Poona, and in two of the five cases at Jhansi, but in none of the three cases at Barrackpore; in a few instances hepatic abscess is mentioned as having occurred after enteric fever. As in previous years, multiple abscesses were found in the majority of the fatal cases.

Alcoholism.—There were 197 admissions with 11 deaths from alcoholism during 1905 against 220 admissions and 9 deaths in the previous year, the corresponding average numbers for the decennium ending 1904 being 250 and 8, respectively;

compared with the decennial average rates, there was, in 1905, a fall in the admission-rate, but a rise in the death-rate. The liability to death from alcoholism has a distinct tendency to rise with age and length of residence in India.

Venereal Diseases.—The recorded admission-rate for all forms of venereal disease in 1905 was 153·7 per mille of strength as compared with 198·5 in 1904, the actual numbers being 10,966 in 1905 and 14,113 in the previous year. The constantly-sick-rate was 15·3 per mille against 17·5 in 1904, and the average period during which a case remained in hospital was 36·26, which is an increase of 4 days on the average stay in hospital of each patient during 1904. The total loss of service, however, was 397,584 days as compared with 454,206 days in 1904 and 572,864 days in 1903. The non-efficiency, thus reckoned, due to detention in hospital on account of venereal diseases during 1905, amounts to about five times the loss incurred on account of enteric fever.

There were 13 deaths (·18 per mille of strength) attributed to venereal diseases during 1905 as compared with 15 (·21 per mille) in 1904 and 10 (·14 per mille) in 1903; the number of men invalided for this cause was 83 (1·16 per mille) as compared with 199 (2·80 per mille) in 1904 and 213 (3·02 per mille) in 1903.

All three Commands record a diminution in the admission-rates for venereal diseases; but for 1905, as in the previous year, the Eastern Command heads the list with an admission-rate of 165·8 per mille followed by the Western with a rate of 155·4. The admission-rate in the Northern Command was only 116·1 per mille, while the rate among troops outside this Command was 166·7; the corresponding figures for native troops are 18·8 in the Northern Command and 19·9 outside this Command. As regards Divisions, venereal diseases were most prevalent in the 10th (Burma) with an admission-rate of 206·9 per mille of strength and the 9th (Secunderabad) with a rate of 194·0, and least in the 1st (Peshawar) with a rate of 74·1 per mille and the 2nd (Rawalpindi) with a rate of 105·7 per mille. Comparing 1905 with the previous year, the Divisions which show the greatest reduction in prevalence of these diseases are the 10th (Burma), the 7th (Meerut), and the 4th (Quetta).

Admission-rates of over 200 per mille were reported from 21 stations, 4 of which had an average strength below 100 men; and, if we omit Lower Topa (377·8 per mille) where the average strength was only 45, the highest rate was recorded at Maymyo (338·1). Excluding stations at which the average strength was less than 100, venereal diseases in the Northern Command were most prevalent at Kasauli (with an admission-rate of 214·7 per mille), Mian Mir (168·7) and Kuldana (158·6), in the Western Command at Deolali (265·5), Bombay (265·0) and Purandhar (246·2), in the Eastern Command at Fort William (283·5), Barrackpore (241·3) and Lebong (229·4), in the Secunderabad Division at Madras (266·8), and Bellary (263·7), and in the Burma Division at Maymyo (338·1), Rangoon (253·8), and Shwebo (175·2). The stations with an average strength of over 100 which in a comparison with the previous year showed the greatest improvement were Maymyo, Meiktila, Agra, Muttra, and Neemuch; altogether 78 stations out of a total of 104 recorded a diminution in the prevalence of venereal diseases during the year under review.

The admission-rate on account of gonorrhœa was 74·8 per mille of strength (the total number of admissions for gonorrhœa being 5,338), and that on account of soft chancre 43·3 per mille as compared with rates of 95·3 and 54·2 per mille, respectively, in 1904. Eight men, as compared with 24 in the previous year, were invalided during 1905 for gonorrhœa.

Syphilis accounted for 2,537 admissions, 13 deaths, and 75 invalidings as compared with 3,488 admissions, 15 deaths, and 175 invalidings in 1904. The admission-rate fell from 49·1 per mille in 1904 to 35·6 per mille in 1905. The figures, however, for 1905 are not strictly comparable with those of 1904 and previous years, as in June, 1904, changes in the methods of classification and treatment of this disease came into force, and these changes considerably affect the statistical returns. Between 1st June, 1904, and the end of that year, the names of 2,947 men were placed on the "syphilis register," but this number doubtless includes the names of many men who contracted the disease in previous years. The number of men whose names were placed on the register during 1905 was 1,470; this represents the number of men who came under treatment for syphilis for the first time, and may be taken as approximately the number of cases of fresh infection during the year, and yields a rate of about 21 per mille. A large number of men required admission or re-admission to hospital while undergoing treatment as out-patients, and the number of men who had relapses after being struck off the register was 35. The average

number of days each case was under treatment was 261. As regards the methods of treatment, the most common whether in or out of hospital were: (1) by injection; (2) by the mouth; of the men in hospital, roughly speaking, for every five treated by injection four were treated by the mouth, while of the men treated out of hospital, for every one treated by the mouth seven were treated by injection.

That there has been in recent years a real reduction in the amount of venereal diseases in the European Army of India, there can be no doubt, although from the changes in classification (for statistical purposes), the introduction of the "syphilis register" and the treatment of some cases as out-patients, it is difficult as yet to gauge the amount of real reduction in prevalence, and the relative values of the causes at work in producing this diminution. At first sight it might be thought that, if in consequence of the above changes admission statistics were not comparable, from the combined death and invaliding rates we should be able to get some approximate idea of the real reduction in the prevalence of these diseases. This, however, is not so. There has been a steady and, latterly, fairly rapid fall in the number of invalidings, and this has not been accompanied by any increase in the number of deaths in India, but the more prolonged and thorough treatment now undergone by those found suffering from venereal diseases may, in a great measure, explain these favourable results.

Medical officers attribute the prevalence of venereal diseases to the youth and ignorance of the soldier, and the difficulty experienced in controlling infection outside cantonments, particularly on the line of march between stations. For limiting the spread of infection reliance is placed chiefly on (1) medical inspections of troops to detect infected men, and place them in hospital; (2) prolonged and thorough treatment, which diminishes the number of sources of infection; (3) the enlightenment of the soldier on the ravages and dangers of venereal diseases; and (4) the encouragement of games, &c., to occupy his leisure hours pleasantly. By such means as these it is reasonable to hope that the prevalence of venereal diseases may be considerably reduced.

Heat-stroke.—The death-rate from heat-stroke was ·77 per mille against ·49 in 1904 and ·77 in 1903; and as usual the mortality is highest in the Northern Command and lowest in the Western. The total number of deaths recorded under this heading was 55 as compared with 35 in 1904 and 54 in 1903. The stations which furnished the largest numbers during 1905 were Peshawar (6), Mian Mir (5), Agra (5), Rawalpindi (3), Lucknow (3), Bombay (3), and Aden (3).

Suicide.—The average annual number of suicides reported in the decade 1891-1900 was 19, and in 1905 the number was 24, of which eleven were by gunshot, four by cut-throat, four by multiple injuries (including fracture of the skull and dislocation of the spine), three by drowning, one by hanging and one by oxalic acid poisoning.

Invaliding.—From the whole European Army in India 1,508 men (21·24 per mille of strength) were invalided in 1905 as compared with 2,507 (35·27 per mille) in the previous year; the chief causes of loss by invaliding have been mentioned. The ratio per 1,000 of strength ranged from 28·61 in the Western Command to 14·95 in the Burma Division. Of the 152 men invalided for debility, 106 were under 30 years of age, and 80 had been less than four years in India; and of the 116 men invalided for tubercle of the lungs 98 were under 30 years of age and 64 had been less than three years in India. Of the total number of men invalided, 47 per cent. were under 25 years of age, an age-period which included 52 per cent. of the total strength; and 82 per cent. of all invalids were under 30 years of age, an age-period which included 85 per cent. of the total strength. As regards length of residence in India, 25 per cent. of all invalids had less than two years' service in this country, and 65 per cent. less than five years; the proportion to total strength of men with under two years' service in India was 43 per cent., and of those with under five years' service 84 per cent. The loss from invaliding among men in the lower age-periods, and also among men of shorter service in India, was not so great as in the previous year.

Officers.—The average strength of commissioned officers with European troops in India in 1905 was 2,323, and of these 1,608 had been under medical treatment. 123 were invalided, and 21 died during the year. The admission, invaliding, and death-rates were lower than in the previous year, while the constantly-sick-rate remained the same. The admission rates for ague, remittent fever, tubercle of lungs,

dysentery, diarrhœa, and hepatic affections show a decrease as compared with the figures for 1904, but those for small-pox, enteric fever, simple continued fever, and respiratory diseases an increase. There were six deaths from enteric fever, the chief cause of mortality, giving a rate per mille of 2·58 which is practically the same as in 1904, and is lower than the rate for the troops (2·99). There were 55 cases of dysentery without a fatality against 63 cases with one death in 1904. There was only one case (non-fatal) of each of the diseases, hepatic abscess and plague. As compared with the incidence on troops the following diseases were more prevalent in proportion to strength; influenza, enteric, remittent, and simple continued fevers, dysentery, diarrhœa, and congestion of the liver, while the officers suffered less than the men from small-pox, ague, hepatic abscess, venereal diseases, tubercle of the lungs and other respiratory diseases. Enteric fever, debility, ague, and dysentery were the chief causes of invaliding.

Women.—There was a distinct improvement in the health of the women during the year under review. The average strength was 3,375, which is an increase of 155 on that of 1904. There were, in all, 2,183 admissions and 37 deaths, giving admission and death-rates of 646·8 and 10·96 per mille respectively, as compared with rates of 697·2 and 12·42 in the previous year; the constantly-sick rate (27·9 per mille) showed an improvement of 2·7 per mille. The average admission, constantly sick, and death rates for the decennium 1894-1903 were 873·4, 36·5, and 15·68 per mille respectively. The chief causes of admission to hospital were, as usual, debility, the diseases peculiar to women, and ague, which together accounted for 61·88 per cent. of the total number of admissions for all causes. Of the 37 deaths five were due to enteric fever, five to childbirth and abortion, and three each to small-pox, tubercle of the lungs, and dysentery. Among the commands and independent divisions, the highest admission-rate was recorded in the Eastern Command, and the lowest in the Burma Division, the highest death-rate in the Western Command, and the lowest in the Secunderabad Division.

Children.—There was less sickness among the children during 1905 than in either of the three previous years, but the constantly-sick rate was exceedingly high, and the death-rate, although much lower than that in 1902, was considerably higher than those of the two previous years. In 1905 the average strength was 5,154, the admission-rate 405·9 per mille, the constantly-sick rate 29·3, and the death-rate 38·8. The chief causes of sickness were respiratory diseases, ague, and diarrhœa, which together accounted for 36 per cent. of the total number of admissions for all causes. There was a considerable diminution in the prevalence of ague, measles, and eye-diseases as compared with 1904. Out of a total of 200 deaths, 38 were attributed to debility and immaturity at birth, 32 to respiratory diseases, 25 to diarrhœa, and 15 each to teething and convulsions, which taken together account for 63 per cent. of the total mortality. There were 26 admissions with two deaths from enteric fever, giving a case-mortality of 8 per cent., while for diarrhœa there were 207 admissions and 25 deaths, yielding a case-mortality of 12 per cent. Among the exanthemata to which children are specially liable there came under treatment during the year 46 cases of chicken-pox, 12 of measles, 2 of rubella, 5 of scarlet fever, and 9 of small pox; there were also 23 cases of whooping cough, 12 of mumps, 8 of diphtheria, and 3 of dengue. Sickness was greatest among children in the Secunderabad Division, and mortality among those in the Eastern Command; sickness and mortality were both least in the Burma Division. Immaturity at birth was the cause of death in 37 per cent. of the total mortality among children under six months. Of the two children who died of enteric fever, one was between five and ten, and the other between ten and fifteen years of age.

Native Troops.

(For Statistical Tables, see pages 134 to 137.)

Sickness and Mortality in 1905.—The health of the native troops during 1905 was exceptionally good. The average strength, excluding those on duty in China and Somaliland, was 123,434, as compared with 124,055 in 1904. The following statement gives a tabular view, enabling an easy comparison to be made, of the statistics of sickness, mortality and invaliding during 1905, the previous year, and the quinquennial period from 1897 to 1901. The rate of admission into hospital was slightly higher than in the previous year, but the constantly-sick and death-rates were the lowest on record. The low death-rate is all the more noteworthy as, out

Native Troops.	All Causes. Ratios per Mille.		
	1897–1901.	1904.	1905.
Admissions	794·4	603·2	607·1
Constantly sick	30·5	23·8	23·2
Deaths	11·92	8·46	8·09
Invalids	12·66	12·98	9·02

of the total number (998) of deaths during the year, 185 were killed at Dharmsala by the collapse of buildings during the earthquake. The slight increase in the admission rate compared with that of the previous year, which was a record figure, was entirely due to the greater prevalence of the minor and less usual causes of sickness; simple continued fever, "other respiratory diseases," dysentery, remittent fever, diarrhœa and enteric fever, alone, showed increased rates, but the increase arising from the combined rates of these diseases amounted to only 18·5 per mille, while the decrease under the heading of intermittent fever alone was 22·9 per mille. A reduced mortality was recorded during the year from all the principal diseases with the exceptions of enteric fever, circulatory diseases and diarrhœa.

The chief causes of sickness in 1905 were intermittent fever, dysentery, "other respiratory diseases," venereal diseases, simple continued fever and pneumonia, in order of their relative prevalence, the first mentioned accounting for 28 per cent. and dysentery for nearly 5½ per cent. of the total number of admissions from all causes. The admission-rate for simple continued fever was more than double that of the previous year, with the result that for the year under review this disease occupies a more important place than pneumonia as a cause of sickness. The chief causes of death were pneumonia, remittent fever and tubercle of the lungs, these diseases accounting for 23·5 per cent., 6·9 per cent. and 6·2 per cent., respectively, of the total number of deaths from all causes. The number of men invalided for discharge from the service during 1905 was 1,113, as compared with 1,610 in 1904, the chief causes of this source of loss being, in order, debility, tubercle of the lungs, rheumatism, venereal diseases and intermittent fever.

The native troops suffered less than the European troops from influenza, small-pox, enteric fever, simple continued fever, diarrhœa, hepatic affections and venereal diseases, but they suffered more from each of the other chief causes of sickness, as also from scurvy.

The average strength of the China Garrison during the year was 1,753. The chief causes of sickness were influenza, "other respiratory diseases," ague, dysentery and venereal diseases, these together accounting for nearly half of the total number of admissions to hospital; the admission-rate fell from 351 per mille in 1904 to 339 per mille in 1905. There were altogether eight deaths, giving a ratio per mille of 4·56; five deaths were attributed to tubercle of the lungs. The average annual strength of the Somaliland Field Force was only 525 as compared with 2,521 in 1904; admissions numbered 596 and deaths two, yielding rates of 1,135 and 3·81 per mille, respectively, against 930 and 17·06, the corresponding figures in 1904. The most prevalent diseases were ague, dysentery and diarrhœa, the admissions for ague alone amounting to 367, *i.e.*, 62 per cent. of the total from all causes. The Aden Column Field Force, the average strength of which was 695, suffered chiefly from ague, dysentery and diarrhœa, these three together accounting for 64 per cent. of all admissions. The actual number of admissions to hospital was 908, which gives a rate of 1,306 per mille; there were two deaths, one from pneumonia and the other from ague. The Sikkim-Thibet Mission Force, having an average annual strength

of 358, reported 293 cases of sickness and 12 deaths during the year, the ratios per mille per annum being 818·4 and 33·52 respectively. Malaria, dysentery and diarrhœa were the chief causes of sickness, and remittent fever was responsible for seven out of the twelve deaths.

Commands and Divisions.—Among the commands in 1905, the Northern had the highest admission, constantly-sick and death-rates, due as regards the chief causes of sickness to the relatively great prevalence of pneumonia, "other respiratory diseases," simple continued fever, and tubercle of the lungs, and as regards the chief causes of death, to the excessive mortality from pneumonia, tubercle of the lungs and remittent fever, as well as to the results of the earthquake at Dharmsala. The Eastern Command, although showing higher admission, constantly-sick and death rates than in the previous year, still ranked first in order of healthiness. Among the ten divisions, if we omit the 3rd (Lahore) Division, in which the constantly-sick and death rates were very high—due to the number of men injured and killed at Dharmsala at the time of the earthquake—morbidity and mortality were greatest in the 2nd (Rawalpindi) Division and lowest in the 9th (Secunderabad) Division.

Geographical Groups.—Judged by the statistics of sickness during the decennium 1891-1900, the geographical groups most unfavourable to the health of the native troops are, in order, Assam (III), Burma Inland (II), Bengal-Orissa (IV), Hill Stations (XII), and North-Western Frontier and Indus Valley (VII), the admission-rates in all of these having been over 1,074 per mille, and the constantly-sick-rate over 35 per mille as compared with 852 and 32, respectively, the corresponding decennial means for India as a whole. During 1905 it is found that these same groups, with the exception of Burma Inland (II), were the most unhealthy. For the past two years Burma Island (II) has had admission and constantly-sick rates lower than the corresponding means for India: in this group the average strength during 1905 was only 2,916, against 6,083, the average for the decennium 1891-1900, so doubtless during the year under review the troops, thus greatly reduced in numbers, were better housed and in more favourable surroundings than formerly; this may in part explain the fall in the admission rate from 1,165 for the above decennium to 539 in 1905. It should be noted that the average strength in Assam (III) was only 949 and in Bengal-Orissa (IV) 2,558, while in Hill Stations (XII) and North-Western Frontier and Indus Valley (VII) the average strengths were 20,224 and 17,946, respectively. The admission-rate for intermittent fever was highest in Bengal-Orissa (IV) and Assam (III); that for dysentery in Bengal-Orissa (IV), Burma Coast (I), Assam (III), and North-Western Frontier and Indus Valley (VII); that for remittent fever in Bengal-Orissa (IV) and Hill Stations (XII); that for influenza in Bengal-Orissa (IV); that for pneumonia in North-Western Frontier and Indus Valley (VII). Enteric fever was most prevalent among native troops in Upper Sub-Himalaya (VI) and Hill Stations (XII). Excessively high rates for simple continued fever, ranging from 57·3 to 20·7 per mille were returned from the five groups Southern India (XI), Burma Coast (I), Hill Stations (XII), Bengal-Orissa (IV) and Deccan (IX); in all these groups the rates reported for 1905 were much higher than the corresponding figures for 1904, and this rise in the rates for simple continued fever was almost invariably coincident with a considerable fall in the rates for malaria. The maximum prevalence of tubercle of the lungs was, as usual, in Upper Sub-Himalaya (VI), Hill Stations (XII) and North-Western Frontier and Indus Valley (VII). The highest death-rates during 1905 were returned from Hill Stations (XII) and Western Coast (X), in which groups there was a high mortality from each of the three chief causes of death among native troops—pneumonia, tubercle of the lungs and remittent fever.

Hill stations below 5,000 feet in height are, as a general rule, the most unfavourable to the health of native troops as regards both sickness and mortality; but during 1905 the death-rate was exceptionally high (27·13 per mille) in hill stations above 5,000 feet, owing to the number of men killed in the catastrophe at Dharmsala. If the deaths at Dharmsala are excluded, the death-rate in hill stations above 5,000 feet is only 7·72 per mille as compared with 9·87, the rate in hill stations below 5,000 feet. It is worthy of note that, as regards the native army, the health of troops located in hill stations above 5,000 feet in height compared unfavourably, both in 1904 and 1905, with that of troops located in the plains.

Stations.—In 1905 there were 36 stations with an average strength of over 1,000, but in only one of these, namely, Dera Ismail Khan, were the admission and death-rates excessive, the rates of this station being 967·0 and 16·52, respectively. The

rates of admission for malaria, dysentery, pneumonia, debility and diarrhœa at this station were all high; and, of the 38 deaths, 22 were due to pneumonia and 5 to remittent fever. Among the regiments with the most unhealthy records during the year were the 11th Rajputs and the 75th Carnatic Infantry, both stationed in Mauritius, who suffered severely from malaria, as did also the 120th Rajputana Infantry at Baroda; and the 1-6th Gurkha Rifles at Abbottabad—ague, simple continued fever, mumps and bronchitis being the chief causes of sickness.

Influenza.—The admission rate on account of influenza fell from 1·8 per mille in 1904 to 1·5 in 1905, and the death-rate from ·02 to *nil.* This disease was much less prevalent, during 1905, among the native troops than among the European troops or prisoners. The largest numbers of admissions were recorded among the troops at Mardan, Karachi, Fort William and Ferozepore, the Northern and Eastern Commands being chiefly affected. The months of greatest prevalence were January, February and September, the high incidence in September being due to all the cases at Fort William having occurred in that month.

Cholera.—There were among the native troops during 1905, only eleven cases of cholera with seven deaths, as compared with 27 cases and 22 deaths in 1904, and 135 cases and 80 deaths in 1903. The Northern Command reported during the year only one case (at Abbottabad) which ended fatally; the Western Command three non-fatal cases (all at Jhansi); the Eastern Command four cases (two at Dinapore and two at Allahabad), all fatal; the Secunderabad Division three cases (all at Madras) with two deaths; the Burma Division returned no case under this heading. The three cases at Madras occurred in the 88th Carnatic Infantry; the disease was present in epidemic form in the city. At Allahabad both cases occurred among the men of the 9th Bhopal Infantry and the source of infection could not be traced; one man was attacked while returning from leave and died a few hours after rejoining his regiment. The case at Abbottabad was attributed to the consumption of infected water or food on the line of march; cholera was prevalent in the surrounding district. Nothing is said by the medical officers regarding the other cases, which occurred in the 12th Pioneers at Jhansi and the 5th Light Infantry at Dinapore.

Small-pox.—There were 77 admissions and one death from small-pox during the year as compared with 56 admissions and three deaths in 1904; the rates per mille of strength for 1905 were ·6 and ·01, respectively, the former being higher but the latter lower than the corresponding mean rates for the decennial period 1891-1900. The Western Command was chiefly affected, returning 50 cases out of the total of 77; the Eastern Command and the Burma Division reported no cases. The largest number of admissions (seven) at any one station was recorded at Bombay, all among the men of the 113th Infantry; there were six cases at each of the three stations Dera Ismail Khan, Mhow and Kirkee. The six cases at Dera Ismail Khan, occurred during August among the men of the 55th (Coke's) Rifles; five had been vaccinated and one bore the marks of small-pox. The men attacked at Mhow had not been vaccinated since enlistment, but bore marks of vaccination in childhood. The patients at Kirkee had contracted the disease in Poona; all had been vaccinated, and one was deeply marked by an attack of the disease which he had undergone many years before. In many reports no remarks are made on the source of infection or on the presence, on the men attacked, of the marks of vaccination or of a previous attack of the disease. In 1905, as in the previous two years, small-pox was less prevalent among the native than among the European troops; the disease is much more fatal to the latter.

Ague, Remittent Fever and Simple Continued Fever.—Intermittent fever accounted for over 28 per cent. of the total number of admissions from all causes in 1905, but the admission-rate, which was 358 per mille in 1901, 274 per mille in 1902, 247 per mille in 1903 and 194 per mille in 1904, fell in 1905 to 171 per mille, which is less than half the mean (349) for the decade 1891-1900. Of the three commands, the Western was chiefly affected during the year, the next place being taken by the Eastern; all three showed a decrease in prevalence as compared with the previous year, but the decrease was greatest in the Northern Command. The admission-rates recorded in all but two of the twelve geographical groups were lower than in 1904, the two exceptions being Bengal-Orissa (IV) and Southern India (XI); the incidence of the disease was highest in Bengal-Orissa (IV), Assam (III), Central India (VIII) and Western Coast (X). Taking India as a whole, the month of greatest prevalence was November, December coming next, and fewest cases occurred,

as usual, in March. October has been, as a general rule, the month of greatest incidence in previous years; the unusual incidence in 1905 may be due to an outburst of infection, or relapses, after the issue of quinine for prophylaxis had been stopped for the season. The stations (excluding those with an average strength under 100) at which the highest admission-rates were recorded, were Baroda (1,319 per mille), Sibi (711), Fort William (662), Ahmedabad (630) and Port Blair (605); at Mauritius the rate was 1,715 per mille of strength. The admission-rate of the troops composing the Aden Column Field Force fell from 1,823 per mille in 1904, to 688 in 1905, 478 admissions having been recorded in the latter year on an average strength of 695 men. At Baroda the 120th Rajputana Infantry were very severely affected, the admission-rate being more than four times as high as in the previous year. The medical officer states that the civil dispensary books show that the disease was also exceptionally prevalent among the civil population, and reasoning by a process of exclusion he has come to the conclusion that the small Vishwamintri River, running in the Gaekwar's territory and coming within a quarter of a mile and to the windward of the lines, is the chief breeding place of mosquitoes. There were many stagnant collections of water along the river side, especially at places where cattle were watered, and it was impossible to deal effectually with these breeding grounds of the mosquito. The increase in prevalence of the disease at Mhow was said to be due to many infected men having arrived from Tibet and the Aden Hinterland; the great increase at Meerut (also Deesa, Indore, &c.) was similarly regarded as due to the arrival of infected troops from very malarious stations. The two regiments located in Mauritius suffered severely; out of a total of 2,000 admissions to hospital, from all causes, of the men of the 11th Rajputs, there were 1,749 admissions on account of malaria (1,658 for ague and 91 for remittent fever); and out of a total of 1,170 admissions from all causes of the men of the 75th Carnatic Infantry, there were 848 on account of ague. The heavy incidence is ascribed to the heavy rains and the general unhealthiness of the island during the year; the men were provided with mosquito nets and quinine was issued prophylactically.

Remittent fever was more prevalent during 1905 than in the previous year, but less prevalent than in 1903, the admission-rate during the year being 8·4 per mille. The death-rate (·56 per mille), however, was less than that (·71) of the previous year; the disease accounted for about 7 per cent. of the total number of deaths from all causes during 1905 as compared with about 8 per cent. in 1904, about 9 per cent. in 1903 and about 10 per cent. in 1902. The incidence of the disease was, as usual, heaviest in the Northern Command, the Eastern Command coming next; the groups most affected were Bengal-Orissa (IV), Hill Stations (XII), Indus Valley and Frontier (VII) and Gangetic Plain (V). The regiments which furnished most admissions were the 11th Rajputs in Mauritius, the 3rd Brahmans at Dibrugarh, the 62nd Punjabis at Fyzabad, the 45th (Rattray's) Sikhs at Nowshera and the 2-4th Gurkha Rifles at Pathankote. The seasonal incidence of this disease is very inconstant; during 1905 the prevalence was greatest in July and least in February.

The admission-rate on account of simple continued fever, which in 1903 was 3·5 per mille and in 1904 was 6·7, rose in 1905 to 14·3, the actual numbers admitted to hospital being 441 in 1903, 829 in 1904, and 1,768 in 1905. Among geographical groups, the highest rates during the year were recorded in Southern India (XI), Burma Coast (I), and Hill Stations (XII). Most cases were reported in the month of June, and fewest in February and March. The regiments returning the greatest number of admissions under this heading were the 1-6th Gurkha Rifles at Abbottabad (174 cases), the 1-1st Gurkha Rifles at Dharmsala (178 cases) and the 2nd Queen's Own Sappers and Miners and the 69th Punjabis at Bangalore (151 and 123 cases, respectively), three stations thus furnishing 626 admissions out of a total number of 1,768 recorded throughout India during the year.

Enteric Fever.—In the whole native army of India, 130 cases with 35 deaths were attributed to enteric fever during 1905, as compared with 70 cases with 16 deaths during 1904, 80 cases with 27 deaths during 1903, 50 cases with 12 deaths during 1902 and 26 cases with 15 deaths during 1901. The admission-rate was 1·1 per mille in 1905 and the death-rate ·28 against rates of ·6 and ·13, respectively, in 1904. The disease was most prevalent in groups VI (Upper Sub-Himalaya), XII (Hill Stations) and IX (Deccan); I (Burma Coast), II (Burma Inland), III (Assam) and IV (Bengal-Orissa) returned no case. There were nearly twice as many admissions as in the previous year, but there were fewer reporting stations and regiments; 29 stations and 44 regiments recorded one or more cases in 1905 as

compared with 33 stations and 46 regiments in 1904. Of the total number of admissions for enteric fever, 31 per cent. (40 cases) were returned from Dehra Dun, 22 per cent. (29 cases) from Abbottabad, 6 per cent. (8 cases) from Peshawar and also from Bolarum; no other station recorded more than four cases. The regiments which reported most cases were the 1-9th Gurkha Rifles (18 cases), the 2-9th Gurkha Rifles (18 cases), the 1-6th Gurkha Rifles (14 cases), the 2-6th Gurkha Rifles (13 cases), and the 1-2nd Ghurka Rifles (8 cases) among Ghurkas, and the 99th Deccan Infantry (6 cases), the 12th Pioneers (4 cases) and the 38th Dogras (4 cases) among sepoys of other classes; in 24 regiments only one case was recorded during the year. The special incidence of this disease among Gurkhas was particularly marked, the disease having been very prevalent among them during the year under review; of 130 cases reported, 83 occurred among Gurkhas (6·0 per mille) and 47 only among sepoys of other classes (·44 per mille). The 83 cases among Gurkhas were reported from nine regiments, whereas the 47 from sepoys of other classes were distributed among 35 regiments. Enteric fever during 1905 was twice as prevalent and twice as fatal among native troops as among prisoners; but, although the disease was nearly fifteen times as prevalent among European troops as among native, the death-rate among the former was only about eleven times as high as among the latter (the case-mortality among native troops was 27 per cent., that among European troops was 19 per cent.).

According to the reports of medical officers, many cases were typical clinical pictures of enteric fever; intestinal hæmorrhage and perforation occurred in several instances, but phlebitis and thrombosis were not observed. Widal's reaction was carried out in the majority of cases; but no *post-mortem* examination seems to have been made. The exceptional prevalence of the disease among the Gurkhas in 1905 is attributed by the regimental medical officers to the large proportion of recruits present owing to recent changes in the number and composition of battalions and the consequent increase in the proportion of young men in the regiments (the majority of those who suffered from the disease were recruits). The exact source of infection in any of these outbreaks was not discovered and medical officers were content to blame water, milk, and food in comprehensive manner. At Dehra Dun the medical officers report that the surroundings of the cantonment were insanitary, being polluted to a great extent by the excreta of native villagers; that the river's banks especially were fouled in this way; that the river water was obviously contaminated by sewage; and that flies were abundant at the time when enteric fever was prevalent in the regiments. The medical officer of the 99th Deccan Infantry at Bolarum states that some cases of enteric fever in the bazaar had come to his notice while acting as civil surgeon, and that the outbreak in the regiment occurred after this and was probably caused by specifically infected water, milk, or food obtained in the bazaar.

Malta Fever.—There was a decided increase in the recorded prevalence of Malta fever, 43 cases with one death having been recorded during 1905 against five cases in 1904, eight cases in 1903, and four cases in 1902. The only month in which no case was reported was May. At Rawalpindi 17 cases occurred, 16 in the 31st Punjabis and one in the 11th Lancers, the chief incidence being in July: at Ferozepore 14 cases, eight in the 14th Sikhs, and six in the 15th Sikhs, with the largest number of admissions in December: at Multan in the 27th Punjabis 10 cases (one fatal), six of which were admitted in April. Besides these the 28th Punjabis at Delhi and the 19th Lancers at Ambala furnished one case each.

As regards the epidemic at Rawalpindi, the diagnoses were made on clinical grounds taken in conjunction with the results of the serum test carried out at the Pasteur Institute, Kasauli. In most cases, on admission to hospital, a search for the malarial parasite was made but invariably with a negative result, and quinine in large doses had no effect on the temperature. In one instance the blood was sent to Kasauli three times and each time the serum reaction was negative both for *M. melitensis* and *B. typhosus*; but after three months' persistent fever of a decidedly undulant type, and intractable neuralgia, the blood was sent a fourth time when the serum was found to agglutinate *M. melitensis* in a dilution of 1 in 80. The medical officer of the 31st Punjabis reports that the admissions took place in batches, suggesting infection by food-stuffs. Several of the men had drunk unboiled goats' milk, which, diluted with water, was commonly used in the lines as a cooling drink. Twelve of the 16 cases were Sikhs, a suggestive fact in view of the special addiction of Sikhs to drinking unboiled goats' milk. At Ferozepore the course of the disease in most of the cases was characteristic and the serum

reaction carried out at Kasauli in all cases positive, although the attempt to get a growth of the micro-organisms by inoculating agar tubes with splenic blood was not invariably successful. The medical officer of the 14th Sikhs is of opinion that the disease was "most probably contracted from the 27th Punjabis, who brought it with them from Somaliland. Four goats were found infected in the lines and destroyed." The Sikhs had taken over the lines from the 27th Punjabis. On the other hand, the medical officer of the 15th Sikhs expresses the opinion that "the disease has probably been present for years but went undiagnosed." It is noteworthy—in connection with the suggestion that mosquitoes carry Malta fever—that the disease was most prevalent in Ferozepore in the month of December. The epidemic in Multan is of special interest as it was from the blood (splenic puncture) of one of these patients that the *M. melitensis* was first isolated in India and the disease thus shown, beyond dispute, to be endemic in this country. The medical officer of the 27th Punjabis reports that he is unable to trace the source of infection and continues,—"I note in the annual report of 1904 the medical officer states that several cases of very protracted fever were returned under remittent fever and he considered this diagnosis unsatisfactory. I may add that I sent specimens of blood from cases which were shown as remittent fever in 1904, and 13 out of 16 gave the serum reaction of Malta fever." The solitary case at Delhi presented very indefinite symptoms and signs and suffered from a continuous remittent pyrexia for about 29 days. There was nothing characteristic in the temperature chart. Vigorous treatment with quinine and diaphoretics had no effect on the temperature and the patient rapidly became weak and anæmic. Eventually, a sample of his blood was sent to the Pasteur Institute, Kasauli, and the serum, while having no effect on *B. typhosus*, agglutinated the *M. melitensis* in a dilution of 1 in 1,280. The Director of the Pasteur Institute, who then sent the medical officer in charge of the case some agar tubes for insemination with the patient's splenic blood, reported that he got a good growth of *M. melitensis* from the tubes thus treated. The course of the disease in the Ambala case was fairly characteristic, and the serum reaction carried out at the district laboratory at Ambala was stated to be "complete and speedy in dilutions of 1 in 40 and 1 in 80."

In analysing the medical reports on these cases of Malta fever, the frequent absence of one or more of the characteristic signs and symptoms is striking; in fact the clinical course of some cases—say the solitary case at Delhi—could hardly have raised any suspicion of this disease, unless by a process of exclusion, and yet this case gave a positive agglutinative reaction in a dilution of 1 in 1,280. The most constant features were a protracted persistent pyrexia unaffected by quinine, marked constipation, and muscular and articular pains usually noted as neuralgic and rheumatic. It must be remembered, however, that even in Malta the variability of the course of the disease has led to a division into clinical types or groups, *e.g.*, the sub-acute or chronic type with frequent relapses; the type with sharp fever lasting only for a short time and ending in rapid convalescence with none of the usual complications of the sub-acute or chronic type, &c. It is not, therefore, surprising to find one or two amongst those 43 cases with a sharp bout of fever lasting only a week or ten days and not leading to much debility or anæmia. Such cases in the absence of the serum test would be very liable to wrong diagnosis. The temperature curve, even when fever was protracted, frequently showed no trace of undulations; it was often very irregular and sometimes remittent, sometimes intermittent. The neuralgic and rheumatic symptoms were frequently absent; the liver and spleen were not always enlarged; and often no sweating was observed. Many cases of this disease must occur, which require the serum test to distinguish them from malaria, typhoid, simple continued fever, rheumatic fever, and gonorrhœal rheumatism; and in all differential diagnoses, where Malta fever is a possibility, the serum test should be carried out. It is now recognised that, if carefully performed with a reliable strain of *M. melitensis*, recently isolated and known to agglutinate with normal human serum only in very low dilution, this test is quite trustworthy.

Plague.—There was a great decrease in the incidence of plague among the native troops in 1905: in 1898 there were 94 cases with 54 deaths; in 1899, 76 cases with 45 deaths; in 1900, 56 cases with 29 deaths; in 1901, 70 cases with 41 deaths; in 1902, 192 cases with 95 deaths; in 1903, 184 cases with 115 deaths; in 1904, 187 cases with 111 deaths; and in 1905, only 79 cases with 46 deaths. Out of the total of 165 stations occupied by native troops during

1905, about 111 were situated in districts where plague was prevalent among the general population, yet in only 27 of these did cases occur among the troops. The largest number of admissions reported from one station was 13 at Bangalore, nine cases occurring in the 2nd Queen's Own Sappers and Miners and four in the 30th Lancers. The only other stations furnishing more than five cases among native troops were Poona, in which ten cases occurred among the men of the 94th (Russell's) Infantry and one case among the men of the 121st Pioneers; Santa Cruz, in which nine cases occurred among the men of the 104th Rifles; and Nasirabad, in which seven cases occurred among the men of the 116th Mahrattas. No other corps returned more than five cases; fifteen reporting stations and eighteen regiments recorded only one case each.

Cerebro-Spinal Fever.—The decrease which has been noted in recent years in the prevalence of cerebro-spinal fever among native troops has been very conspicuous during the year under review, only one case (fatal), viz., in the 57th Rifles at Peshawar, having occurred in the whole native army during 1905, against six cases with four deaths during 1904 and also in 1903, 18 cases with 17 deaths during 1902, and 28 cases with 21 deaths during 1901.

Scurvy.—There has been a marked diminution in the prevalence of scurvy during the year, the total number of admissions into hospital for this disease in 1905, being only 213, which gives a ratio of 1·7 per mille as compared with ratios of 4·0 per mille in 1904, 2·4 per mille in 1903 and also in 1902, and 3·2 per mille in 1901. In these figures the statistics of troops serving in Somaliland are not included; in 1905 these troops returned only one case as compared with 899 cases in the previous year. The statistics, however, of the Aden Column Field Force are included in the above figures and this force, which furnished 94 admissions for this disease in 1904, recorded two admissions only in 1905; to this reduction is due in part the low rate recorded during the year under review. About 64 per cent. of the 213 admissions for this disease were recorded among troops in the Western Command and 18 per cent. among those in the Northern; and, as regards geographical groups, over 39 per cent. of the admissions occurred among troops in Hill Stations (XII) and over 9 per cent. among troops in Central India (VIII), these being the two groups which usually furnish most cases. The five regiments which were most affected all belonged to the Quetta Division of the Western Command; these regiments were the 101st Grenadiers (14 cases), 106th Hazara Infantry (12 cases), the 124th Infantry (12 cases), the 126th Infantry (12 cases) and the 105th Mahrattas (11 cases). The medical officer of the 101st Grenadiers at Quetta states that all the 14 men admitted for scurvy had contracted the disease in Somaliland or at Aden, that two of the men had to be invalided as they had lost their teeth and were unfit for further service, and that fresh onions had a very beneficial effect on the course of the disease.

Tubercle of the Lungs.—It is satisfactory to note that during 1905 both the admission and death-rates on account of tubercle of the lungs among native troops have shown an improvement on the exceptionally low rate recorded in the previous year. The accompanying table shows the admission and death-rates for this disease (1) among the native troops of India as a whole and (2) among Gurkhas, for each year of the past decade. The admission-rate of the native army during 1905 was

Years.	Admission and Death Rates for Tubercle of the Lungs.			
	Native Army of India as a whole.		Gurkha regiments.	
	A	D	A.	D
1896	2·5	·65	7·4	3·59
1897	2·6	·79	10·3	5·55
1898	3·5	·63	13·1	4·45
1899	3·3	·68	15·4	5·09
1900	3·7	·78	14·4	4·34
1901	4·2	·84	13·1	3·95
1902	4·3	·80	15·6	4·24
1903	5·9	·68	28·9	2·88
1904	3·9	·51	10·6	2·66
1905	3·1	·50	6·1	1·58

the lowest recorded since 1897, and that of Gurkhas was the lowest recorded in the decade 1896-1905. The decrease in the death-rate is still more marked; the rates for 1905 of both the Native army as a whole and of the Gurkhas were the lowest in the decade, the rate of the latter being exceptionally low. The decrease in prevalence of this disease was most marked in the statistics of the Assam (III) group, the admission-rate in this group falling from 7·5 per mille in 1904 to 1·1 per mille in 1905: Upper Sub-Himalaya (VI) recorded the highest admission-rate (4·7 per mille) during the year, the Hill Stations (XII) coming next with an admission-rate of 4·6 per mille. The chief factor determining the position of the various groups, relative to prevalence of this disease, is the number of Gurkhas located therein; and the decline during 1905 in the rates of groups that usually occupy a high position on this list was due chiefly to the great diminution in prevalence of the disease among Gurkhas, and, in the case of Assam, to the reduction in the number of Gurkhas located in that group. As regards commands, the incidence of the disease during 1905 was, as usual, greatest in the Northern Command with an admission-rate of 5·4 per mille as compared with a rate of 3·1 per mille for India as a whole. The admission-rate during the year of troops, excluding Gurkhas, in the Northern and Eastern Commands was 4·2 per mille, that of Gurkhas serving in the same two commands was 5·2 per mille, the latter ratio being less than half the corresponding figure for the previous year; the death-rate, however, of Gurkhas in these two commands, although much lower than in previous years, is still more than twice as high as among troops of other classes located in the same commands. In the whole native army of India during 1905, this disease accounted for 385 admissions and 62 deaths, of which 85 admissions and 22 deaths occurred among Gurkhas. These figures give admission and death-rates for the native army of India, excluding Gurkhas, of 2·7 per mille and ·36 per mille, respectively, and rates for Gurkhas of 6·1 per mille and 1·58 per mille, respectively. It is noteworthy that in 1905 for the first time the regiment recording the highest number of admissions for tubercle of the lungs was not a Gurkha regiment. The regiments with the largest numbers of admissions were, in order, the 21st Punjabis (16 cases) the 2-1st Gurkhas (9 cases), and the 1-2nd Gurkhas, the 7th Gurkhas, the 12th Pioneers, and the 113th Infantry (8 cases each). The 21st Punjabis were stationed in Northern China for the first four months of the year and after arrival in India were at first located at Multan and subsequently at Jhelum: the medical officer reports that the disease was contracted in China and was aggravated by the dust storms of that country, and that the disease was more frequent and fatal among Dogras than among other classes of sepoys in the regiment. The exceptional incidence of the disease among the 7th Gurkhas is attributed by the medical officer to the unusual hardships and the severe weather to which the men were exposed at Dharmsala and Bakloh.

There were six cases returned as non-tuberculous phthisis during the year, as compared with three in 1904, six in 1903, and 23 in 1902.

Pneumonia and other Respiratory Diseases.—The admission-rate for pneumonia in 1905 was 12·5 per mille and the death-rate 1·90 per mille as compared with 11·7 and 2·32 per mille, respectively, in 1904. The increase in prevalence, compared with the previous year, was due to the greater incidence of the disease in the (VI) Upper Sub-Himalaya and (IV) Bengal-Orissa groups, each of which records an increase in the admission-rate of about 5 per mille over that of 1904. Despite its diminished fatality this disease was still the chief cause of death among native troops in 1905, accounting for over 23 per cent. of the total number of deaths. The North-West Frontier and Indus Valley (VII) retained its position as the group in which pneumonia was most prevalent during the year, Upper Sub-Himalaya (VI) and Central India (VIII) coming next; in (XII) Hill Stations the disease was not so prevalent as in previous years. The months of greatest incidence were, as usual, January, February, and December. Among stations with an average strength over 100 the highest admission-rates were recorded at Kherwara (91·2 per mille) and Kotra (46·7 per mille), both in the (VIII) Central India group and at a height of over 1,000 feet above sea-level. As regards regiments, the largest numbers of cases during the year occurred in the Meywar Bhil Corps at Kherwara, the 4th Rajputs at Malakand, the 38th Dogras at Mian Mir, the 52nd Sikhs at Kohat, and the 59th Rifles at Edwardesabad. The disease was much more prevalent but much less fatal among the native troops than among prisoners. Among European troops

pneumonia was more prevalent and fatal, but among prisoners less prevalent and fatal than in the previous year. The medical officers of the 4th Rajputs and 52nd Sikhs consider the extreme cold experienced during December, January, and February, especially on manœuvres, as in part responsible for the prevalence of the disease.

The highest admission-rates for other respiratory diseases during 1905 were recorded in the Northern Command and, among groups, in (XII) Hill Stations, (III) Assam and (VII) North-West Frontier and Indus Valley, the last named being the group from which the highest admission-rate on account of pneumonia was returned. The admission-rate of the whole native army of India on account of other respiratory diseases rose from 21·1 per mille in 1904 to 28·5 per mille in 1905, but the death-rate remained practically the same—·25 per mille in 1904 and ·23 per mille in 1905. Excluding stations where the average strength was less than 100, the highest admission-rates were recorded at Mir Ali Khel (147·8), Fort Jamrud (111·1), Abbottabad (106·1), Thal (96·6), Kherwara (82·4), Ootacamund (75·8), Kirkee (68·1), Bhuj (67·5), Quetta (66·6), Ahmedabad (65·0) and Sehore (63·3); the average strengths of Fort Jamrud, Mir Ali Khel and Bhuj were under 200. Bhuj furnished the high death-rate from other respiratory diseases of 6·13 per mille. Among regiments the 1-6th Gurkhas at Abbottabad, the 64th Pioneers at Ootacamund, the 3rd Sappers and Miners at Kirkee and the 54th Sikhs at Nowshera recorded the highest numbers of admissions during the year. These diseases were most prevalent during the cold months, and, according to the medical officers, were largely due to exposure to cold on field days.

Dysentery and Diarrhœa.—During 1905 the admission and death-rates on account of dysentery were 32·5 and ·18 per mille, respectively, as compared with 31·5 and ·27, respectively, in 1904, the latter rates having been the lowest recorded up to that date. There has thus been a slight increase in the admission-rate, but the death-rate of the year is the lowest on record. Although the admission-rate on account of this disease of the native army as a whole has risen, eight of the twelve geographical groups showed a decrease in prevalence compared with the previous year, the four exceptions being (IV) Bengal-Orissa (the admission-rate being about 35 per mille more than during 1904), (V) Gangetic Plain, (VIII) Central India, and (XII) Hill Stations. The disease was most prevalent during 1905 in (IV) Bengal-Orissa, (I) Burma Coast, (III) Assam, and (VII) North-West Frontier and Indus Valley. Omitting stations with a strength below 100, the highest admission-rates were recorded during the year at Barrackpore (177·5), Aden (157·6), and Fort William (131·1), the first and last named belonging to the (IV) Bengal-Orissa group: the highest death-rates were reported at Kotra (6·67), Kherwara (2·94), and Fort William (1·62). Among regiments dysentery was most prevalent in the 95th Russell's Infantry at Singapore, the 102nd Grenadiers at Mhow, the 8th Rajputs at Lucknow, the 2-10th Gurkhas at Lansdowne, and the 78th Moplah Rifles at Dera Ismail Khan. The medical officer of the 95th Russell's Infantry states that the epidemic in that regiment was caused by the well-water being contaminated. The prevalence of the disease in the 102nd Grenadiers was attributed to the food and water of the men having been unavoidably exposed to dust and sand while on service in the Aden Hinterland.

The admission and death-rates on account of diarrhœa rose from 6·7 and ·05 per mille, respectively, in 1904 to 7·5 and ·06, respectively, in 1905. This disease, like dysentery, was most prevalent in the Eastern Command and, among groups, in (IV) Bengal-Orissa, (III) Assam, and (X) Western Coast. Excluding the smaller stations, the highest admission-rates were recorded at Fort William (93·9), Dibrugarh (37·2), Alipore and Barrackpore, all, except Dibrugarh, which is in Assam, being in Bengal-Orissa. The total number of deaths from this disease among the whole native army was only seven. Several of the medical officers in charge of regiments at the above stations report that the chief causes of the prevalence of diarrhœa were insufficient or improper cooking of food and chills caught while bathing before meals.

Venereal Diseases.—Venereal diseases were nearly eight times more prevalent among the European troops during 1905 than among native troops, the admission-rate being only 19·6 per mille of strength among the latter as compared with an admission-rate of 153·7 per mille of strength among the former; or, otherwise expressed, among European troops an annual average strength of 71,343 gave 10,966 admissions for

venereal diseases, while among native troops an annual average strength of 123,434 gave only 2,419 admissions. The admission-rate in 1905 of the native troops of India, excluding those serving in China and Somaliland, was 1·0 per mille less than in the previous year; the admission-rate of the China Garrison under this heading fell from 43·8 per mille in 1904 to 20·0 per mille in 1905 and that of the Somaliland Field Force from 11·1 in 1904 to 1·9. Altogether 7 men died from, and 79 men were invalided for, these diseases during the year as compared with 6 and 107, respectively, the corresponding figures for 1904. During 1905, venereal diseases were, as usual, least prevalent among native troops located in the Northern Command, but the admission-rate of this Command is five per mille greater, while those of the Western and Eastern Commands are, respectively, four and two per mille less, than in 1904; consequently, the differences in prevalence of these diseases in the three commands are very slight during the year under review. The admission-rate on account of these diseases among Gurkhas in the Northern and Eastern Commands was 34·7 per mille (the same as in 1904); that among native troops of other classes located in these two commands was only 14·5 per mille; that of the whole native army of India, excluding Gurkhas, was 17·6. These figures show that the Gurkhas suffered much more than the sepoys of other classes and that the latter suffer much less in the Northern and Eastern Commands than in other parts of India. Excluding stations at which the average strength of native troops was less than 100, the highest admission-rates for venereal diseases were recorded at Bakloh, Abbottabad and Dharmsala in the Northern Command; at Bhuj, Bombay, and Satara in the Western Command; at Naini Tal, Shillong, and Kohima in the Eastern Command; at Bellary and Vizianagram in the Secunderabad Division; and at Maymyo and Fort Stedman in the Burma Division. Of these stations, Bakloh, Bombay, Satara, Kohima, Vizianagram, Maymyo, and Fort Stedman appeared in the corresponding list in this report for 1904. For native troops in India as a whole, the admission-rate for syphilis was 7·7 per mille, for soft chancre 4·6 per mille, and for gonorrhœa 7·4 per mille, as compared with 8·8, 4·5, and 7·3 per mille, respectively, in 1904.

Beri-beri.—During 1905 beri-beri accounted for only 15 admissions and two deaths against 49 admissions and five deaths in 1904 and 122 admissions and eight deaths in 1903. Of the 15 admissions during the year, ten occurred in two regiments, viz., seven in the 81st Pioneers stationed in the early part of the year at Secunderabad but during the latter part of the year on service in the Aden Hinterland, and three in the 73rd Carnatic Infantry at Aurangabad. The other cases were reported, one each in the 96th Berar Infantry at Secunderabad, in the 20th Deccan Horse at Bolarum, in the 97th Deccan Infantry at Bolarum, in the 63rd Palamcottah Light Infantry at Vizianagram, and in the 88th Carnatic Infantry at Madras. The medical officer of the 81st Pioneers states that all the cases in that regiment were of the wet type except one (that of a man, admitted in the Aden Hinterland, who had twice suffered from the same disease in India), which was of the dry variety. The patients were isolated and the quarters they had occupied disinfected with a view to check the spread of the disease. In 1904 there were six cases of beri-beri in the 81st Pioneers at Secunderabad; and in the same year, the 73rd Carnatic Infantry, which was at that time stationed at Singapore, recorded 29 admissions for this disease.

Guinea-worm.—There was a considerable decrease in the number of admissions for guinea-worm in 1905, the total being 609 against 730 in the previous year. The largest number of cases occurred as usual, in the (VIII) Central India group, the (IX) Deccan, the (XII) Hill Stations, and the (VII) Indus Valley groups coming next. Over 15 per cent. of the total number of cases were reported from Kherwara, where the Mewar Bhil corps is stationed, the number of cases in this regiment during the year amounting to 110, which yields a ratio of 262 per mille of strength. The disease is very common in the native Bhil villages. Excluding Kherwara, cases were most numerous at Poona and Quetta.

Suicide.—During the 10 years, 1895-1904, there were altogether 154 cases of suicide, giving an average of about 15 per annum. In 1905, there were 14 cases, of which nine were by gun-shot, three by hanging, one by drowning, and one by opium-poisoning.

Jails of India.

(For Statistical Tables, *see* pages 138 to 140.)

Sanitary Conditions in 1905.—The importance of prison sanitation in India may be measured by the fact that close upon half a million persons pass through the prisons every year. It is too much to hope perhaps that any considerable proportion of them should profit by lessons of order and cleanliness that they have been taught during their imprisonment; but it is of great importance that none of them should carry away with them from the prison the seeds of disease.

The more closely the problems of jail hygiene are examined, the more evident does it become that the secret of health in the prison is the exclusion of disease from outside, by thorough medical inspection and segregation of newly admitted prisoners, and the limitation of the evil results of any failure of these precautions by making the spread of contagion and the development of latent disease unlikely.

These preventive measures require suitably located, well drained jail sites, properly constructed roomy buildings, the control of the water and food supplies, and efficient management. If these conditions are assured, sickness among convicts should be reduced to a minimum, and the death-rates should be much lower than the death-rates of the free population—the comparison being made not with the crude general death-rates, but with the much lower rates among men and women of the same ages as the prisoners. Prison death-rates, particularly in district jails, depend largely on the health of the prisoners that have to be admitted, but proper appliances, well managed, should banish contagious diseases from the prisons. The proof of the success of jail hygiene is not the low death-rate of a prosperous, healthy year, but the steady growth of the difference between the jail death-rates and the general death-rates in unhealthy years.

In 1904, general conditions were peculiarly favourable to the health of the prisoners; in 1905 conditions in most parts of the country were unfavourable. The weather in the early part of the year was exceptionally cold and raw, the monsoon rains began late and ended early, and the heat of the summer and autumn was excessive. The cold weather crops of 1904-5 were below the average everywhere, except in the Punjab, the Frontier Province, Assam and Burma; and the kharif was bad or below normal in Bengal, Eastern Bengal, and Assam, in parts of Madras, Bombay and the United Provinces, in the unirrigated areas of the Punjab, and in the Frontier Province. Except in Bombay and the Punjab the health of the general population was below the average, and the death-rate, in spite of the great reduction in plague mortality, was higher than in 1904.

The mean daily number of prisoners of all classes in India and the Andamans during 1905 was 106,265, or 1,940 more than in the previous year. The prison populations were slightly lower than in 1904 in the United Provinces, the Punjab, and the Central Provinces, elsewhere they were higher, notably in Burma and Madras, where the mean daily strengths were greater by 935 and 827 respectively.

In the Andamans an addition of 376 to the mean daily strength of 1904 brought the figure of 1905 to 14,348, which is more than a seventh of the Indian daily prison population. It is necessary to treat the statistics regarding convicts in the Andamans separately because the conditions under which they live differ widely from those under which the inmates of prisons in India and Burma live, their sick-rate being nearly three times, and their death-rate twice, as large as the Indian means.

In the jails of India and Burma the mean daily strength in 1905 was 91,917, and the following are the salient statistical facts of the year 1905 compared with those of 1904 and the years 1901-1904. The population of 1905 was greater by 1,564 than that of the previous year, but less by 4,453 than the four years' mean; the rate of admission to hospital was 647 per thousand, or 29 per thousand less than the rate in 1904, which was the lowest on record, and 138 less than the four years' mean; the number constantly sick was 28 per thousand, identical with the figure of 1904, but four below the four years' average, and the death-rate was 19·23 per thousand, 1·62 higher than the unprecedentedly low rate of 1904, but 2·35 below the

four years' average. The admission-rates in all the various administrations were lower in 1905 than the respective means of the previous four years, but only in Burma, the United Provinces, the Punjab, and the Frontier Province were the admission-rates lower than in 1904. The constantly-sick rates were higher in 1905 than in 1904 in Eastern Bengal and Assam, in Bengal, the Frontier Province, the Central Provinces, and Bombay; and in the first three of those provinces they were higher than the means of the four years 1901-1904. The death-rates of 1905 were lower than those of 1904 in Bombay, Burma, the Punjab and Madras, elsewhere there was an increase, and in Burma, Eastern Bengal and Assam, and in Bengal the death-rates of 1905 were higher than the four years' average. The lowest death-rates were 16·33 per thousand in the Punjab, which, with the exception of the rates, 15·89 and 16·05 recorded in 1896 and 1897, respectively, is the lowest in the history of the province, 15·79 in the Central Provinces, and 15·87 in Madras, where the next lowest rate on record was 16·13 in 1899.

Owing to the transfer of fourteen Bengal districts to the new province of Eastern Bengal and Assam, the province of Bengal lost the central jails of Dacca and Rajshahi, and twelve district jails with a total accommodation for 4,749 prisoners; and by the transfer of Sambalpur from the Central Provinces to Bengal, those Provinces lost and Bengal gained one district jail accommodating 155 prisoners.

The daily average number of convicted prisoners in 1905 was 86,375, among whom the death-rate was 19·23 per thousand, the rates ranging from 32·02 in Eastern Bengal and Assam to 14·62 in the Central Provinces. In the following statement are compared the average daily convict populations of central and district jails, and their admission and death-rates in the several administrations in the years 1901 to 1905 inclusive.

Administration.		1901.			1902.			1903.			1904.			1905.		
		Average strength.	Ratio per 1,000 of strength.		Average strength.	Ratio per 1,000 of strength.		Average strength.	Ratio per 1,000 of strength.		Average strength.	Ratio per 1,000 of strength.		Average strength.	Ratio per 1,000 of strength.	
			Ad.	D.		Ad.	D.		Ad.	D.		Ad.	D.		Ad.	D.
Bengal*	Central	10,202	1,064·8	22·35	10,368	1,054·1	22·57	9,316	1,015·8	17·50	9,519	803·7	18·91	7,631	1,041·0	25·55
	District	8,979	1,179·9	33·97	9,268	1,084·6	29·56	8,160	1,162·7	30·76	8,483	1,154·1	21·81	5,885	931·5	23·96
Assam†	Central	—	—	—	—	—	—	—	—	—	—	—	—	1,886	608·2	24·92
	District	1,463	1,167·7	25·29	1,362	890·5	30·10	1,296	809·3	29·32	1,430	650·6	28·68	4,392	1,248·4	35·06
United Provinces	Central	12,204	825·3	25·0	11,475	653·5	23·4	9,387	642·8	12·9	9,313	502·7	12·78	9,389	489·8	15·76
	District	15,323	853·5	24·54	14,563	793·5	18·40	11,958	947·9	17·39	12,777	687·6	15·34	12,292	620·0	18·22
Punjab	Central	6,366	144·0	29·69	5,749	124·5	26·44	4,858	85·0	18·94	4,822	915·2	25·09	4,570	714·9	17·94
	District	6,278	1,141·6	24·85	6,179	1,100·3	25·25	6,341	1,056·3	19·71	5,930	961·2	15·85	5,961	740·3	16·10
North-West Frontier Province.	Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	District	881	108·7	9·08	893	110·3	28·00	971	121·3	16·48	1,055	118·2	16·11	1,077	1,053·9	21·36
Central Provinces	Central	4,023	801·4	26·85	3,465	957·3	23·09	2,676	772·1	16·82	2,468	489·9	10·13	2,418	574·0	14·06
	District	1,729	925·4	28·34	1,418	920·0	25·39	1,113	1,002·3	22·45	1,085	847·9	18·43	864	862·3	16·20
Madras	Central	7,181	584·0	22·70	7,042	499·1	18·32	5,775	447·6	18·35	6,129	439·9	15·01	6,695	506·6	15·98
	District	3,635	510·6	26·98	3,660	351·9	17·76	3,124	578·7	20·49	3,143	591·8	18·45	3,436	554·1	16·01
Bombay	Central	4,064	1,485·5	29·04	3,846	707·0	33·80	3,026	347·3	19·17	3,039	556·8	17·11	3,092	654·6	12·94
	District	6,358	767·7	39·16	6,207	721·4	26·58	4,889	654·8	31·70	4,868	639·1	20·95	4,836	583·3	20·26
Burma	Central	7,246	513·8	14·49	6,823	510·6	13·34	6,691	460·3	14·05	6,962	381·1	21·69	7,491	278·9	17·62
	District	4,264	603·7	16·18	4,253	573·0	18·58	3,981	501·6	22·61	4,151	390·5	14·21	4·460	367·7	17·04
Total of the above Provinces.	Central	51,286	922·0	23·73	48,768	791·9	22·25	41,729	680·8	16·30	42,252	591·5	17·51	43,172	598·8	18·18
	District	48,910	908·4	27·54	47,803	839·3	23·20	41,833	848·1	23·24	42,922	791·3	17·99	43,203	723·2	20·39

* Excluding in 1905 jails transferred to Eastern Bengal and Assam. † Including in 1905 jails transferred from Bengal.

In India as a whole the convict populations are fairly equally divided between central and district jails, but, while the central jail populations are considerably the larger in Bengal, and much the larger in the Central Provinces, Madras, and Burma in the other administrations the district jail populations are the greater. In India as a whole the admission and death-rates are lower among central than district jail populations, and this is the rule with few exceptions in the several administrations; it is, therefore, important when comparing provincial death-rates to take into account the proportions of the total populations confined in central and district jails. It will be observed that the death-rate in central jails, 18·18 per thousand in 1905, is higher than the rates in both 1903 and 1904, but the death-rate in district jails, 20·39, while higher than that of the preceding year, is lower than those of the other years.

Central and District Jails.—The following table shows the distribution according to length of time spent in prison, with the actual number of deaths, and the death-rates of convicts in the jails in the years 1901 to 1905:—

Years.			1. Strength.		2. Deaths.		3. Ratio per 1,000 of Strength.		
			Not exceeding six months.	Above six months and not exceeding one year.	Above one year and not exceeding two years.	Above two years and not exceeding three years.	Above three years and not exceeding seven years.	Above seven years.	Total.
1901	Central Jails.	Strength	14,368	9,769	9,637	6,690	7,221	3,434	51,119
		Deaths	305	212	269	145	205	81	1,217
		Ratio per 1,000 of strength	21·2	21·7	27·9	21·7	28·4	23·6	23·8
	District Jails.	Strength	26,993	10,547	6,766	2,447	1,784	413	48,950
		Deaths	818	277	180	28	36	8	1,347
		Ratio per 1,000 of strength	30·3	26·3	26·6	11·4	20·2	19·4	27·5
1902	Central Jails.	Strength	12,789	8,961	8,941	6,941	7,332	3,565	48,529
		Deaths	280	188	206	122	220	69	1,085
		Ratio per 1,000 of strength	21·9	21·0	23·0	17·6	30·0	19·4	22·4
	District Jails.	Strength	25,610	10,697	6,623	2,584	1,883	361	47,758
		Deaths	588	278	148	49	38	8	1,109
		Ratio per 1,000 of strength	23·0	26·0	22·3	19·0	20·2	22·2	23·2
1903	Central Jails.	Strength	11,122	7,463	7,970	5,715	6,862	2,486	41,618
		Deaths	181	112	137	91	122	37	680
		Ratio per 1,000 of strength	16·3	15·0	17·2	15·9	17·8	14·9	16·3
	District Jails.	Strength	23,242	9,612	5,314	2,279	1,650	209	42,306
		Deaths	587	205	108	28	37	7	972
		Ratio per 1,000 of strength	25·3	21·3	20·3	12·3	22·4	33·5	22·9
1904	Central Jails.	Strength	11,446	7,605	8,328	5,642	6,749	2,475	42,245
		Deaths	196	132	151	70	140	51	740
		Ratio per 1,000 of strength	17·1	17·4	18·1	12·4	20·7	20·6	17·5
	District Jails.	Strength	23,849	9,567	5,348	2,192	1,872	213	43,041
		Deaths	464	157	90	35	24	2	772
		Ratio per 1,000 of strength	19·5	16·4	16·8	16·0	12·8	9·4	17·9
1905	Central Jails.	Strength	12,322	7,963	8,606	5,733	5,936	2,925	43,483
		Deaths	203	143	141	76	174	48	785
		Ratio per 1,000 of strength	16·47	17·96	16·38	13·26	29·31	16·41	18·05
	District Jails.	Strength	23,285	9,771	5,741	2,315	2,063	236	43,413
		Deaths	477	195	125	29	42	8	876
		Ratio per 1,000 of strength	20·49	19·96	21·77	12·53	20·36	33·90	20·18

It will be observed that even in the central jails a large proportion of the total population have been in confinement for less than one year, and that the death-rates in the central jails among such prisoners are much lower than the rates among them in the district jails; that the death-rates in district jails are highest in the first six months of imprisonment; and that in the central jails the highest rate is invariably recorded among prisoners who have spent between three and seven years in prison.

Causes of Sickness and Mortality.—The chief causes of sickness were intermittent fever (admission-rate 181·7 per thousand), dysentery (81·6), abscesses, ulcers, and boils (71·2), diarrhœa (39·2) and respiratory diseases other than pneumonia (26·4); while the principal causes of death were tubercle of the lungs (death-rate 3·19 per thousand), dysentery (3·01) and pneumonia (2·28).

Intermittent Fever.—There were 16,704 prisoners admitted to hospital on account of intermittent fever, or 2,821 fewer than in 1904, and little more than half the number admitted from the somewhat larger population (105,020) in 1901. This disease was, as usual, most prevalent in October, and the admission-rates were

highest in the North-West Frontier Province (344·0 per thousand), and Bengal (290·7), the rates ranging in the other provinces from 260·1 per thousand in Eastern Bengal and Assam, to 85·6 in Madras and 51·0 in Burma. The mean death-rate ascribed to intermittent fever was ·91 per thousand. In the Central Provinces and North-West Frontier Province no death was recorded; in Bengal and Eastern Bengal and Assam the death-rates were 2·75 and 1·87 per thousand, respectively, and in the remaining provinces the rates varied between ·79 in Madras and ·13 in Bombay.

Remittent Fever.—There has been a great reduction during the last five years in the numbers of cases and deaths returned under the designation remittent fever; but in contrast to the gradual reduction in the numbers of cases of intermittent fever, the fall in the numbers of cases of remittent fever has been abrupt. In 1901 there were in all the jails 295 admissions and 41 deaths ascribed to this disease, and in the following year the number of admissions rose to 346, and there were 40 deaths; in 1903 the number of admissions and deaths fell to 143 and 19 respectively; in 1904 the figures were 102 and 15, and in 1905 the number of admissions increased by 7 to 109, and the number of deaths by 5 to 20.

During the quinquennium ending with 1905, there were in all 995 cases of remittent fever, of which 647 occurred in three provinces, Bombay (314), Bengal (174), and Burma (159); and in the different provinces the case-mortality varied greatly between 29·6 per cent. in the Punjab and 5·3 per cent. in the Central Provinces. The vast majority of the cases—875 out of 905—occurred in district jails and the case-mortality among them was 12·5 per cent., as compared with 21·7 per cent. among the 120 cases reported from central jails. In 1905 the largest numbers of cases occurred in Bengal (21), the United Provinces (21), and Madras (19); but while in the United Provinces the largest number of cases in any one jail was five, in Bengal there were 13 cases in the district jail at Champaran, and in Madras there were 12 cases in the district jail at Tanjore.

As usual, the disease was least prevalent in the cold weather, but in no other respect does its incidence agree with that of intermittent fever. The reports on fatal cases do not generally throw a clear light upon the nature of the disease, although in many instances the disease does not seem to have been malarial. We have, then, a disease more frequent in some provinces than in others, less fatal, but more frequent in district than in central jails, the incidence of which, in the course of a single year, declined by half; the question arises, what is its nature? Many cases are no doubt severe attacks of malarial fever, others are *kala azar*, and others again are confessions of failure to diagnose. Our knowledge of the nature of Indian fevers becomes wider and more exact every year, but it is still far from complete, and it is just these obscure cases of fever which are likely to give an opportunity to the pathologist to enlarge our knowledge.

Quinine prophylaxis is in general use, and so also, apparently, are measures to prevent the breeding of mosquitoes in jails. Little mention is made by Inspectors-General of special measures undertaken in the jails, or of the results obtained by them, and this omission is perhaps justified by the familiarity of the subject, and by the great reduction of malaria among prisoners in recent years. The very fact of success should, however, encourage us to redoubled efforts, for a great deal can still be done. Making every allowance for the varying prevalence of malaria in different localities and in different years, the mean admission-rate represents extraordinary variations in the different administrations, and in the different jails under them. There were in 1905 seven jails with a mean daily strength of over 100 prisoners, in which the admission-rate for intermittent fever was over 600 per thousand—to take a figure more than three times as great as the mean—and in some of these the frequency of malarial fevers does not appear to have attracted the special notice of the Medical Superintendent. The explanation in some cases, no doubt, is the fact that in other respects the prisoners were very healthy with low death-rates, and in others the difficulty of draining of the jail and its surroundings is considered insuperable from want of funds. It is, however, wiser in the long run to spend money on drainage than on hospital charges, to which has to be added the loss of labour; and in most cases the reports appear to warrant the hope that well devised efforts intelligently directed and persistently carried out would be successful.

Dysentery.—The total number of recorded cases of dysentery in 1905 was 7,496, equal to an admission-rate of 81·6 per thousand, which is considerably lower than the rate in the previous year (85·7), and the mean of the previous four years (89·9).

The number of deaths was 277, equal to a death-rate of 3·01 per thousand, which, while slightly higher than the exceptional rate (2·91) of 1904, is considerably lower than the four years' average (3·87). As compared with 1904 there was a diminution in the number of cases in all administrations except Eastern Bengal and Assam and Madras, the decrease being specially remarkable in Burma, where the number fell from 561 to 358, and in the Punjab, where it fell from 570 to 327. In India generally the disease was most prevalent in August and least prevalent in February, the important provincial exceptions being the United Provinces and the Punjab, in both of which the maximum occurred in September, and Madras, where it occurred in October. The dysentery death-rates in 1905 were higher than in 1904 in all provinces except Bombay, where the rate remained stationary, Burma, where the reduction was ·21 per mille, the United Provinces, where the fall was ·40 per mille, and the Punjab, where the death-rate decreased from 2·56 to ·52 per thousand. The case-mortality varied greatly, ranging from 10·0 per cent. in the North-West Frontier Province to 1·8 per cent. in the Punjab, the mean for India being 3·7, and the percentages in all provinces except the North-West Frontier Province, Burma (9·2), United Provinces (5·3), and Madras (4·8) being below the mean.

It is a misfortune when a disease is given a pseudo-scientific name from a symptom, for, unless this symptom is peculiar to one disease, a serious obstacle is placed in the way of the discovery of its etiology, and when this is discovered, there is confusion regarding the assignment of the name.

Dysentery affords a striking example of the truth of this statement. The symptom from which the name is taken is common to several diseases, it has taken a comparatively long time to discover their etiology, and great confusion prevails regarding their causes. Our knowledge has, however, advanced rapidly in recent years, and the problem is so nearly solved that it is perhaps possible to classify the diseases with some approach to correctness. We may divide dysenteries into three classes: (*a*) epidemic or bacillary dysentery, caused by one or other type of the dysentery bacillus; (*b*) tropical, endemic or amœbic dysentery caused by the *Entamœba histolytica* of Schaudinn; and (*c*) false dysentery, including diseases characterised by discharges with more or less dysenteria, caused by inflammation of the bowel from any other cause, *e.g.*, bacteria, *Entamœba coli* and *Balantidium coli*.

As bacillary dysentery is not necessarily epidemic, and may be endemic, and as amœbic dysentery occurs outside the tropics in places where it is not endemic, it is desirable to avoid alternative names, and adhere to the terms bacillary dysentery and amœbic dysentery.

There are at least two well-known types of the bacillus of dysentery—the Shiga-Kruse and the Flexner. On the one hand, however, authorities are agreed that these are not specifically distinct germs, but rather races of the same germ displaying biological differences; on the other, observers by the discovery of minor differences in the fermentation and agglutination reactions of the bacilli of various epidemics are adding to the number of types, thus Hiss describes four types, and Shiga, writing of the dysenteries of Japan, five.

It is probable that there is no need to depart from a conception of the specific unity of the bacilli of dysentery, and that the importance of para-dysenteric bacilli may be limited to the preparation of vaccines or sera which may have to be polyvalent. Shiga states that the bacilli persist for a long time in the intestines of convalescents, and may be carried by the apparently healthy, and Conradi has found dysentery bacilli in the stools of healthy persons in Metz. The life of the bacilli outside the body is, according to Shiga, of short duration. Frost and Whitman found that at 17°—20° C., while the bacilli exposed on dry wood or paper died out rapidly, they lived for days and even for a month on dry bread or rice; and that although they seldom lived for a week in distilled water, they lived in milk until it dried up. The Shiga type was less hardy than the Flexner type, and the higher the temperature the sooner the bacilli died. Observations connecting the severe summer diarrhœas of children with the bacilli of dysentery are accumulating; according to Jehle and Charleton the Shiga-Kruse type is most common in epidemic diarrhœa, and the Flexner type is most common in sporadic cases. The connection of diarrhœa in children with dysentery has an obvious application to the prevention of the disease, while the rôle played by flies in the contamination of food as described by Sandilands not only demonstrates the necessity for the immediate destruction of dysenteric dejecta, but suggests other means of precaution, such as the suitable location of dysentery wards and latrines.

It is important that the cause of each case of dysentery should be ascertained. Leaving the clinical signs and symptoms on one side, we have the following means of diagnosis: (1) serum diagnosis—the bacillus of dysentery is agglutinated only by the blood of the subjects of bacillary dysentery, but the agglutinating property does not appear in the blood until about the end of the first week; (2) the recovery of the bacillus by cultivation from the fæces; and (3) the discovery of amœbæ in the stools. In fresh material from an acute case of dysentery, under a low power, the amœbæ appear as small, clear, shining discs; higher magnification revealing active movements. They may be distinguished from large leucocytes by their greater size (10—30 μ Kartulis) by the greater development of pseudopodia, and by more lively movements; and from the *Entamœba coli* by the generally distinct division of the clear ectoplasm from the granular endoplasm, which in the *Entamœba coli* are distinct only when it is moving actively, by the small, generally eccentric nucleus, by the absence of a nuclear membrance, and by the formation of small cysts (3—6 μ) which according to Lesage, can be readily seen a few minutes after the addition of iodised water. Difficulty in seeing the amœba may arise from absence of movement which may be due to too low temperature of the slide or the presence in the stool of an antiseptic drug, *e.g.*, calomel (Kartulis).

It is probable that the *Entamœba histolytica* is not the only pathogenic amœba, and although Kartulis states that all dysenteric amœbæ examined by him have been the same, he says that Schaudinn informed him that he recognised two varieties, and that Ruge believes the dysenteric amœbæ of China differ from those found in Java. Numerous cultivation experiments have been made with amœbæ, and Lesage describes the successful cultivation of *Entamœba histolytica* in association with a bacterium of the coli group on washed, sterilized agar. The same observer states that the resistance of the living amœbæ in culture is remarkable, the amœbæ living for four to five months, and the cysts for six to eight months at a temperature of 20°—25° C. As pointed out by Schaudinn the cysts are the more dangerous form, probably because they are more resistant to the gastric juice, and cysts are formed in the intestine at the termination of a case, and, outside the body, whenever, apparently, conditions are unfavourable to the life of the amœba; cold, for instance, will cause amœbæ to form cysts.

Infection may persist for very long, even after the patient is apparently quite cured, a refuge of the amœbæ being the vermiform appendix. Of especial interest is the fact that these amœbæ may be the cause of intractable chronic diarrhœa. Meyer cites two cases where the diarrhœa had been of 15 years' duration, and a third of 18 years' duration, in which cure followed specific treatment administered on the discovery of the presence of amœbæ in the stools.

In the Andamans, Major Anderson, I.M.S., reports that the *Entamœba histolytica* was found in 488 of 920 cases of dysentery examined, but in only 29 of these cases were the amœbæ unaccompanied by other protozoa. In order to check these figures an examination was made of the dejecta of 118 men admitted to hospital for fever, of whom 34 had suffered from dysentery more than a year previously, and 84 had never been admitted to hospital for dysentery. Among the 34 the amœba was found in 15; among the 84 amœbæ were present in 17; in a few instances these amœbæ resembled those found in the dysenteric cases, but in most instances the amœbæ conformed with the description of *Entamœba coli*.

In view of the connection established between dysentery and abscess of the liver, the proportions between the numbers of these diseases occurring among prisoners and others is interesting. In the Andamans in 1905 there were 2,359 cases of dysentery admitted into hospital—perhaps we may assume that 1,000 were cases of amœbic dysentery—and three cases of abscess of the liver; in the last five years there have been 10,428 cases of dysentery and 11 cases of abscess of the liver. In the Indian jails in the last five years there have been 42,152 cases of dysentery and 42 cases of abscess of the liver. In the Native Army the proportion was much higher, 23,516 cases of dysentery and 72 cases of abscess of the liver. The contrast between these figures and those for the European Army is an extraordinary one; among British soldiers, during the five years there were 5,581 cases of dysentery and 860 cases of abscess of the liver. It is evident then that although dysentery may be a necessary antecedent of abscess of the liver, abscess of the liver is not among natives a common sequel of dysentery; and it appears that there must be some other condition operative among Europeans. Musgrave notes that experiments in his laboratory indicate that amœbic abscess rarely or never develops in

an otherwise normal liver, notwithstanding the fact that amœbæ may be almost constantly poured into it from an ulcerated bowel. Allusion may be made to the report of an isolated experiment in which Dr. Gauducheau injected pus from a tropical abscess into the mesenteric vein of a dog; the result was not an abscess of the liver, but amœbic dysentery.

Diarrhœa.—The number of cases admitted to hospital under this heading was 3,603, of which 68 ended fatally, the mean admission and death-rates being, respectively, 39·2 and ·74 per thousand, the lowest on record. The highest admission-rates were 90·9 per thousand in Bengal and 90·0 in Eastern Bengal and Assam; in the other administrations with one exception, the rates varied between 42·9 in the Punjab and 17·6 in Burma; the exception is Madras, where the admission-rate was 3·5 per thousand and only 36 cases were recorded as diarrhœa. The highest death-rates were 1·15 per thousand in Bombay and 1·06 in Bengal, the rates in Madras, ·30, the Central Provinces, ·28, and the Punjab, ·17, being the lowest.

Respiratory diseases, other than pneumonia.—The number of cases admitted on account of diseases classified under this heading was 2,428, and the number of deaths was 85, the rates being 26·4 per thousand and ·92 per thousand as compared with 25·1 and ·65 in 1904. The increase in the admission-rates which depended to some extent on the greater prevalence of influenza was common to all administrations, except the North-West Frontier Province, the Central Provinces and Madras, and the increase in the death-rates was common to all except the North-West Frontier Province and Madras.

Pneumonia.—In spite of the wide diffusion of influenza the number of cases of pneumonia fell from 965 in 1904 to 896 in 1905, and the number of deaths from 252 to 210, the admission and death-rates, 9·7 and 2·28 per thousand, respectively, being the lowest on record. The reduction in the admission-rates was most remarkable in the Punjab and the North-West Frontier Province; in Burma, Madras, the United Provinces and the Central Provinces the admission-rates rose. The death-rate fell in Eastern Bengal and Assam, the Punjab, the North-West Frontier Province and Bombay, the further reduction from 19·34 per thousand to 15·79 in the Sind Gang in that province being satisfactory. The case-mortality varied considerably in the different provinces being exceptionally high in Bengal (34·1 per cent.), Burma (31·0), Eastern Bengal and Assam (28·1), and comparatively low in the Punjab (17·7), Madras (16·7), the Central Provinces (14·3), and the North-West Frontier Province (11·1). The mean stay in hospital of fatal cases was between eleven and twelve days; in the United Provinces and Bombay the mean duration of fatal cases was only about seven days owing to the large numbers of cases which proved fatal in the first few days of the disease.

The importance of efficient ventilation in the prophylaxis of pneumonia is recognised everywhere, and endeavours are generally used to secure the best ventilation of the sleeping wards possible; but it is obvious that the difficulty of this task may be greatly increased by climatic conditions and badly constructed buildings. When cases occur in the prisons those measures of segregation and disinfection considered necessary in other cases of infectious fevers are general carried out. Attention has recently been drawn to the possible rôle played by oral sepsis in predisposing to the more serious prison diseases, and in this connection the recently made statement that the pneumococcus, which is present in the mouths of a certain proportion of healthy persons, increases in virulence in a neglected mouth and disappears altogether from a thoroughly cleansed one, may be noted.

Tubercle of the lungs.—As compared with the previous year there was a considerable increase in the prevalence and fatality of cases of tubercle of the lungs, the number of admissions rising from 763 to 803, and the number of deaths from 279 to 293—an admission-rate of 8·7 per thousand and a death-rate of 3·19. The disease was as usual most prevalent in the jails of Bengal (admission-rate 13·5 per thousand), Eastern Bengal and Assam (11·4) and Madras (10·5), and least prevalent in the jails of Bombay (6·1), the Central Provinces (5·6) and the North-West Frontier Province (3·8); while the death-rates were highest in Bengal (4·02 per thousand) and the Punjab (4·43), and lowest in the Central Provinces (1·97) and the North-West Frontier Province (1·52).

In India generally, tubercle of the lungs was the cause of 16·6 in every hundred deaths. This percentage varied greatly in the different administrations, the more remarkable percentages being 27·1 in the Punjab, 22·3 in Burma, 12·5 in the Central Provinces, 10·4 in Eastern Bengal and Assam, and 7·7 in the North-West Frontier Province. In India generally, and in Burma, the United Provinces, the Punjab, Bombay and the Central Provinces, tubercle of the lungs was a more frequent cause of death among prisoners than dysentery. Analysis of the statistics shows that the mortality from tubercle of the lungs was much higher among those convicts who had been more than three years in prison than among the remaining body of convicts, the death-rates being 8·06 among the former and 2·59 among the latter. Unfortunately the returns giving the numbers admitted to hospital do not discriminate between short and long term prisoners, and the death-rates alone cannot give accurate information regarding the prevalence of the disease among short and long term prisoners, respectively, because a larger number of the former than of the latter are likely to be released before the termination of the disease. Of the 90 long term prisoners that died, however, 47 were in good health at the time of conviction, and the mean duration of their illness from admission to hospital until death was 124 days, so that it is reasonable to suppose that the great majority contracted the disease in prison. There are considerable differences in the mean stay in hospital of these cases in the different administrations; in Bombay the mean was only 68 days, in Madras 83 and in the Central Provinces 84, while in the United Provinces the number of days spent in hospital was 153, and in Bengal 142.

The nature of tubercular infection and the manner of the entry of infection into the human body are still the subjects of a discussion to which allusion is made only for the purpose of directing attention to the possibility of a proportion of cases of tubercle in the jails being the development of a latent infection. That this is possible is suggested by the large number of cases which occur among apparently healthy prisoners in jails where the hygienic precautions taken might be expected to exclude the probability of infection; and the possibility emphasizes the importance of a strict watch over the health of those prisoners whose physical conformation or previous history indicates the possible presence of latent tubercle.

The principles of prevention as recently described by Koch in the Nobel lecture are thoroughly understood in the jails, and are generally applied. In many prisons tuberculous patients are treated in a special open-air ward, but these wards are not all equally well constructed. Care should be taken that, while the occupants of the ward are not exposed to chilling winds, ventilation is thorough, and that there is no dead space in the roof in which the air can stagnate; the existence of such a dead space will render the air of a ward, even if it be completely open on all sides, unpleasant in still weather. The arrangements for the reception and disposal of tuberculous sputum should be complete and the ward should be kept scrupulously clean, otherwise it may become a centre for the collection and distribution of tuberculous material.

Anæmia and Debility.—There were 1,014 cases and 50 deaths recorded under this heading, with admission and death-rates of 11·0 and ·54 per thousand, respectively, as compared with 12·4 and ·41 in the previous year and means of 13·5 and ·57 in the previous four years. These conditions of bad health were far more prevalent in the jails of Eastern Bengal and Assam than in that of any other administration, the admission-rate being 32·2, and the death-rate 2·66 per thousand, compared with 17·9, the next highest admission-rate, recorded in the Punjab, and ·76 the next highest death-rate, recorded in Bombay. The lowest admission-rates were 4·3 in Madras and 3·1 in Burma, and in all provinces the admission and death-rates were below the means of the last four years except in Eastern Bengal and Assam where both rates were higher, Bengal and the North-West Frontier Province where admission-rates were higher, and the Punjab where the death-rate was higher. The geographical distribution of the high death-rates is important; they were highest in Assam (Group III.) 5·75, Western Coast (X.) 1·73 and Bengal and Orissa (IV.) ·92. The convenience of the heading anæmia and debility for the purpose of hospital registers is obvious, but the condition must depend upon some cause either in the victim or his surroundings, and the occurrence of large numbers of such cases in a jail should lead an Inspector-General to ascertain whether they are due to failure to diagnose or to some remediable defect in the conditions of the prisoners' lives. The *post-mortem* records show easily recognizable organic disease in many cases; a few cases were almost certainly *kala azar;* and anchylostomes

were frequently found in the intestines. In this connection attention may be drawn to the revival in a modern form by Shipley and Fearnsides of the old idea that the anæmia of anchylostomiasis is due to a hæmolytic toxin secreted by the anchylostomes —probably in the cephalic glands.

Small-pox.—There were in all 31 cases of small-pox, including 14 in Bombay and four each in Madras and the United Provinces, as compared with 25 cases and four deaths in 1904.

Plague.—There were 66 cases of plague in the jails, of which 46 were fatal, as compared with 37 cases and 24 deaths in 1904. In the United Provinces (26 cases) the disease appeared in eleven jails; in Bombay (15 cases) in four jails; in Bengal (14 cases) in six jails; in the Punjab (6 cases) in three jails; in the Central Provinces (3 cases) in two jails; in Burma and Ajmer one case each.

Cerebro-spinal Fever.—The decrease in the numbers of cases of this disease was maintained, the number of cases and deaths falling from 23 and 18 in 1904 to 10 and 9 in 1905, and the number of jails in which cases occurred from eleven to six.

Enteric Fever.—There were 64 cases of enteric fever and 15 deaths, a larger number of cases than in any of the past ten years except 1902, when there were 69 cases and 15 deaths. There were 28 cases in the Madras jails, Coimbatore contributing 18 and Cannanore six. In Eastern Bengal and Assam there were 12 cases, ten in the Mymensingh jail and two at Rangpur. No case was reported in Bombay, the Central Provinces or the North-West Frontier Province. In most instances the *post-mortem* observations supported the diagnosis.

Cholera.—The number of cases of cholera was 73, of which 40 were fatal against 47 and 31 in 1904, and 97 and 57 in 1903. Most of the cases (37 with 14 deaths) occurred in Madras, an outbreak in the jail at Rajamundry accounting for 30 cases of which ten were fatal. In Eastern Bengal and Assam there were twelve cases and all were fatal. Except at Rajamundry the cases were sporadic, and the jails in Bombay and the North-West Frontier Province were free from the disease.

The following paragraphs deal with the more important features of the provincial reports.

Bengal.—The year was comparatively unhealthy; there was a slight increase in the mean daily population and the admission and death-rates rose from 883 and 19·55 per thousand in 1904 to 954 and 24·91. The difficulty in providing sufficient accommodation has been increased owing to the more complete separation of different classes of prisoners that is now required; and it is evident that steps must be taken to obtain more accommodation, since in 16 jails there was overcrowding among convicts throughout the year and in nine jails the under-trial wards were not sufficiently large for the number of under-trial prisoners in confinement. The principal causes of admission to hospital were intermittent fever (30·49 per cent. of all admissions) and dysentery and diarrhœa (30·12); and the principal causes of death were dysentery (26·3 per cent. of all deaths), tubercle of the lungs (16·1), intermittent fever (11·0), and pneumonia (8·5). There were 2,783 admissions to hospital on account of dysentery and 93 deaths, a case-mortality of 3·34 per cent., which is below the mean for Indian jails (3·7), and may be due, as the Inspector-General suggests, to prompt admission to hospital of mild cases, or to the presence of a less deadly form of the disease. Regarding oral sepsis the Inspector-General remarks that medical officers have not been able to trace any connection between it and the prevalence of dysentery, and they do not consider the condition in any sense scorbutic. Even if there is no direct connection between oral sepsis and dysentery it cannot, as the Inspector-General says, be good to swallow pus organisms; the loss of teeth must result in dyspepsia which is generally considered a predisposing cause of dysentery; we have seen that the presence of oral sepsis may determine an attack of pneumonia, and there is evidence that it may furnish an entrance for tubercular infection in the young; the removal of the condition, therefore, is an important detail of jail hygiene.

There was a slight reduction in the number of cases of intermittent fever, the total being 4,120, compared with 4,271, in the preceding year, but the number of fatal cases rose from 12 to 39. Nearly half the deaths occurred in cases of malarial cachexia and it seems possible that some of these were cases of *kala azar*. Quinine prophylaxis is used by Koch's method, and the Inspector-General remarks that the result is not seen in any considerable reduction in the number of admissions for

fever, but most medical officers comment on the fact that the disease is of a milder type and more easily cured. Tubercle of the lungs was more prevalent and fatal than in the previous year, and the Inspector-General proposes to segregate at Berhampore tubercle cases from all jails.

The death-rate in four jails was over 40 per thousand; one of them, Khulna, is a small jail and the death-rate must vary. The high death-rate in the others is attributed to overcrowding or to structural defects in the barracks.

Eastern Bengal and Assam.—There was a slight increase in the average strength—from 6,211 in 1904 to 6,401 in 1905—of the prisoners in the jails of Eastern Bengal and Assam. The year was unhealthy, the admission, constantly-sick and death rates rising from 979, 37 and 22·38 per thousand, respectively, in 1904, to 1,081, 46, and 32·96 in 1905, rates which are higher than those recorded in recent years. The chief causes of sickness were dysentery and intermittent fever, and, to a less extent, diarrhœa. The deaths were due to dysentery, tubercle of the lungs and beri-beri which occurred in an epidemic form at Sylhet and caused 21 deaths. In five of the jails, with a population of over one hundred, the death-rates exceeded 45 per thousand, namely, Barisal (62·87), Gauhati (58·25), Dibrugarh (57·69), Sylhet (54·79), and Tezpur (45·28).

United Provinces.—Climatic conditions were not favourable to the health of prisoners: the cold in the early months of the year was extreme, and the hot weather was more trying than usual. There was considerable distress among the agricultural population; and influenza was prevalent. In these circumstances it is satisfactory to note a considerable reduction in the admission-rate from 612 per thousand in 1904 to 569 in 1905, and a fall in the constantly-sick-rate from 28 to 27. The death-rate, however, rose from 14·56 of the previous year, which was the lowest ever recorded, to 17·31; this is not a high rate and the Inspector-General remarks that at least a third of the deaths were due to diseases contracted before admission to jail or to injuries. The increase in mortality was due to heat apoplexy and the occurrence in the jails of a large number of cases of plague.

The chief cause of sickness was intermittent fever (32 per cent. of all admissions); and the chief causes of death were pneumonia (17·3 per cent.), tubercle of the lungs (15·4) and dysentery (11·2). In seven jails with a strength of over 100 prisoners including the central jail at Benares the death-rates were over 30 per thousand. The high death-rate in the Benares central jail (33·6) is of particular interest as the situation, arrangement and management of the jail are satisfactory, and the death-rate of 1904 was only 10·37. The population of the jail had been reduced and it contained a very large proportion of old men whose latent organic defects rendered them unable to withstand the peculiarly unhealthy conditions prevalent in the Benares district. At Gorakhpur the special precautions taken for the purpose of preventing dysentery getting into the jail, to which reference was made last year, were successful and only one death from dysentery occurred in the jail.

Punjab.—The daily average population has been steadily falling since 1900, and in 1905 the daily average convict population was lower than it has been since 1896.

The year 1905 is a memorable one in the annals of the Punjab jail administration: the admission-rate fell from 907 per thousand in 1904 to 708, the constantly-sick-rate from 31 to 26, and the death-rate from 19·76 to 16·33—one of the two lowest rates on record. Very remarkable was the decline in the numbers of deaths from dysentery from 30 to 6, and from pneumonia from 64 to 29. The number of deaths from tubercle, however, rose from 40 to 51 and there were 13 deaths from sunstroke, four from cholera and five from plague. The number of admissions to hospital on account of malarial fever fell from 4,014 to 2,834, and the number of deaths from 10 to 6, which is attributed to "the administration of quinine in large doses at stated intervals during the malarial season and especially to prisoners after admission, together with the abolition of breeding-grounds of mosquitoes in the vicinity of jails."

Colonel Bate, C.I.E., I.M.S., who had held the office of Inspector-General of Prisons in the Punjab since April, 1891, demitted office on promotion. The improvements in the condition of the prisoners effected by him during his long

tenure of office may be judged from the following figures: in the ten years ending 1891 the mean death-rate was 32·77, in the following ten years the mean death-rate was 22·14, and in the four years ending 1905 it was 20·19.

North-West Frontier Province.—The daily average population was 1,314, showing a continuation in the steady increase due to heavier sentences and fewer transfers to the Punjab jails. There was occasional overcrowding especially in the Kohat and Abbottabad jails. The admission-rate fell from 1,102 per thousand in 1904 to 960, but the constantly-sick and death-rates rose from 32 and 14·65, respectively, to 34 and 19·79. The principal causes of sickness were ague, abscesses and influenza, and dysentery was the chief cause of death.

Central Provinces and Berar.—The average daily population fell from 3,740 in 1904 to 3,547 in 1905; but the admission, constantly-sick and death-rates all rose—from 586 to 630, from 20 to 21 and from 12·57 to 15·79. The number of admissions on account of malarial fever was greater than in 1904, and this fever accounted for 30·27 per cent. of all admissions, but there was no fatal case. Tubercle of the lungs, pneumonia, other respiratory diseases and dysentery were the principal causes of death. The number of cases of pneumonia increased from 25 to 35, and it was suspected that infection was conveyed by blankets, which are to be systematically boiled in future. In the five central jails there were only 81 admissions and three deaths from dysentery, and it is noteworthy that in the Jubbulpore central jail, which was recently notorious for the high mortality from dysentery in it, a daily average population of 840 was entirely free from that disease throughout the year. The number of cases of diarrhœa fell from 169 to 128, but the Inspector-General considers that the number should be still lower, and alludes to the practice of habitual convicts securing a holiday in hospital on account of diarrhœa induced by eating irritant seeds.

Madras.—There was a considerable increase in the daily average strength from 9,320 in 1904 to 10,147. The admission-rate rose from 439 to 469, but the constantly-sick and death-rates fell from 20 and 16·52 per thousand to 19 and 15·87, both lower than any hitherto recorded. The death-rate would have been only 14·49 but for the occurrence of cholera of which there was an epidemic (30 cases, but only ten deaths) at the Rajamundry central jail and (seven cases with four deaths) in the Madras Penitentiary and Nellore district jail. Ague (18·25 per cent. of all admissions), dysentery (13·63 per cent.), simple continued fever (7·24 per cent.) were the chief causes of sickness; dysentery (19·3 per cent. of all deaths), tubercle of the lungs (14·9 per cent.), pneumonia (9·3 per cent.) and cholera (8·7 per cent.) were the chief causes of death. The special hospital for tubercle at Trichinopoly was in use with much advantage throughout the year; the construction of the special hospital at Bellary has not been completed.

Bombay.—The daily average population increased slightly to 7,851, and the admission and constantly-sick-rates rose from 600 to 603, and from 25 to 27 per thousand, respectively, but the death-rate fell from 19·22 to 17·45, the lowest rate recorded.

The principal cause of sickness was ague which accounted for 22·30 per cent. of all admissions. The chief causes of death were pneumonia (17·5 per cent. of all deaths) and tubercle of the lungs (13·1 per cent.). There was overcrowding in the Common Prison, Bombay, Rajkot, Hyderabad, and Shikarpur. The Thana jail was overcrowded for a short time, but during the greater part of the year the population was kept below the number for which accommodation is provided according to scale. The death-rate of this jail fell from 23·39 in 1904 to 14·83 and although tubercle continues to be the principal cause of mortality, the measures taken—the provision of a tubercle ward, early isolation of cases, the renewal of every floor in the prison and the thorough disinfection of the floors—have brought about a great diminution in the prevalence of the disease.

The total number of cases of pneumonia fell from 119 to 106 and the number of deaths from 38 to 24. In the Sind Gang there was no virulent outbreak and the Inspector-General quotes Major Jackson's opinion that the improvements effected in the surroundings of these prisoners will render pneumonia no longer formidable among them.

Burma.—There was a considerable increase in the daily average strength from 11,704 in 1904 to 12,639 in 1905, a number not far short of the total, 15,284 for which accommodation is provided. The health of the prison population continued excellent, the admission and constantly-sick-rates falling from 387 and 20 per thousand to 320 and 17—the lowest rates on record—and the death-rate from 18·63 to 17·01, the third lowest rate on record. The food of the prisoners was the subject of particular attention during the year, and arrangements were made to secure pure drinking water for the inmates of the jail at Mandalay. The success which has attended the efforts to improve the hygiene of this jail may be gauged from the reduction in the death-rate from 79·30 per thousand in 1904, to 17·31. The jail at Thayetmyo, however, was unhealthy in 1905, the death-rate rising from 12·91 in the previous year to 37·66, due to the prevalence of dysentery and diarrhœa for which the flooding of the jail's surroundings owing to an unusual rise of the river and the pollution of the river water are blamed. There were seven cases of beri-beri and four deaths in this jail in which, it may be noted, a great outbreak of that disease occurred in the summer and autumn of 1881. The recent outbreak was promptly checked by the removal of the patients from the jail and the disinfection of their clothing and bedding and of the dormitories occupied by them. The chief causes of sickness were abscesses and ague and the chief causes of death were tubercle of the lungs and dysentery. The term "abscess" includes the results of injuries, many of which were found to be self-inflicted.

Ajmer, Mercara, Quetta and Secunderabad.—In the jail at Ajmer there was some overcrowding, but the health of the prisoners was remarkably good, the constantly-sick and death-rates among a population of 412 being 22 and 17 per thousand, respectively. Prisoners often suffer from guinea-worm attributed to the drinking water. There was one death from plague. In the Mercara jail the average daily population was 87, and the constantly-sick and death-rates 11 and 45·98 per thousand, respectively. The general health was good; of the four deaths, three were due to pneumonia. At Quetta the average daily population was 70; there was no death. At Secunderabad the average daily population was 85; there was no death.

Andamans.—In 1905 the rainfall recorded in the Andaman Islands was 101·09 inches, which is twenty inches less than the fall of the preceding year and about seventeen inches below the mean of the preceding five years. The convict population continues to increase, the average daily strength rising from 13,972 in 1904 to 14,348. No change has been effected in the permanent barracks, but many bamboo and thatch barracks were constructed and occupied during the year, while two additional wards for phthisical patients and an additional ward for lunatics were opened, one of the former being used for general hospital purposes. No change has been made in the water-supply or in the conservancy arrangements. The swamp to the north of the female jail was partially drained, but still includes pools in which anopheles mosquitoes breed. No change was made in the diet scale, but the quality of the supplies has been improved. The Senior Medical Officer considers that the inferior quality of the wheat, particularly its mouldiness, is a principal cause of the dysentery which is so prevalent among the convicts and the results of a series of experiments carried out with wheat cleaned and ground by different methods afford evidence of the correctness of his view. He recommends that in future (1) all foreign matter and diseased grain should be carefully removed from the wheat before grinding; (2) the wheat and *atta* should be systematically dried; (3) excess of bran should be removed from the *atta* after grinding; (4) each sack of food material should be carefully inspected before issue for use; and (5) the food should be stored in a godown rendered as far as possible damp proof and weevil proof. The use of several kinds of *dhal* has been introduced. The vegetables issued to the convicts have been of much better quality owing to the increased number of gardens in various stations, with the result that scurvy is rarely seen. Cleaned vegetables are now issued to the inmates of the female and cellular jail. Improvements have been effected in the milk supply.

The admission-rate fell from 1,909 per thousand in the previous year to 1,898, but the constantly-sick and death-rates rose from 64 and 34·75 per thousand to 68 and 38·96. The increases in the constantly-sick and death-rates were due to the prevalence of dysentery and cellulitis in the first part of the year; and the

constantly-sick-rate is kept up by the detention in hospital of all recognized cases of phthisis.

Dysentery is the great scourge of the Settlement; the number of cases in 1905 was 2,359 or 89 more than in the previous year, and the number of deaths rose from 111 to 187, equal to a death-rate of 13·03 per thousand, four times the Indian mean death-rate. The admission and death-rates from tubercle of the lungs were 11·4 and 6·48 per thousand; both rates lower than those of the preceding year, and this encourages the hope that the vigorous measures adopted against the disease are successful. The average stay in hospital of fatal cases was 230 days.

Malaria was the cause of 17,881 admissions and 12 deaths, compared with 16,395 admissions and 34 deaths in 1904. The most common anopheles found in the Settlement resembles *A. rossi*, but Lieutenant-Colonel Alcock, I.M.S., considers it differs sufficiently to deserve another name and has provisionally named it *A. andersonii*. This mosquito and *A. barbirostris* are considered by Major Anderson, the Senior Medical Officer, to be the common carriers of malaria. Cellulitis which caused 188 admissions and 18 deaths was, as already noted, most prevalent early in the year, but became much less virulent as the year advanced; the improvement being attributed by the Senior Medical Officer to improved barrack accommodation.

Conclusion.—The general results of jail management during the year, so far as the health of the prisoners is concerned, were satisfactory, and the Government of India have good reason to be well pleased with the care and skill displayed by the Inspectors-General and the medical staff of the prison administrations.

The General Population.

(For Statistical Tables, *see* pages 141 to 143.)

Registration of Vital Statistics.—Vital statistics have recently attracted a good deal of public attention on account of the discussion in the press of two topics of general interest. In England the decline of the birth-rate has been the subject of numerous articles, and in India attention was aroused by a statement that the progressive increase in the registered death-rates was a proof of the impoverishment of the mass of the Indian people.

It has become a proverb that anything may be proved by statistics, but this is really only another way of saying that they must be used with care. Vital statistics, unfortunately, present peculiar difficulties on account of the large number of special circumstances which must generally be taken into account before a conclusion can be drawn from them; for instance, one town may have a low birth-rate, and another a low death-rate; it is as wrong to condemn the former, before ascertaining that it contains the normal proportion of married couples at the reproductive ages, as it is to assume that the latter is healthy without finding out whether the low mortality is not due to the small numbers of young children and elderly persons in the population. Indian vital statistics present special difficulties. We have to depend upon the census population, because the registered returns are too inaccurate to allow of calculations of intercensal populations, with the result that as the decennium advances rates become unduly high; figures have been registered in certain areas for many years, but registration is even now not universal; the facts are nearly everywhere collected by an unpaid and generally illiterate agency; registration is compulsory only in the towns where the municipal authorities seldom enforce the bye-law; and the different social customs of the people often render the application of experience gained elsewhere misleading.

There is often greater difficulty, especially in towns, in obtaining information regarding births than deaths, and consequently infantile mortality which is calculated from the numbers of births and deaths of infants registered during the year, is excessive.

It is not possible here to detail the allowances which must be made in respect of the registration figures, but it seems necessary to explain, that however valuable they may be for the purpose of comparing the condition of the people in a province from year to year; and, due allowances being made, for comparing the condition of the populations in different provinces in any year, the figures registered are not yet generally accurate, and the degree of accuracy differs in the various provinces. This will be appreciated after reference to the following statement which gives the registered birth and death-rates per 1,000 of the population in three of the larger provinces in the years 1885, 1895, 1904, and 1905.

Year.	Madras.		Bengal.		United Provinces.	
	Birth-rate.	Death-rate.	Birth-rate.	Death-rate.	Birth-rate.	Death-rate.
	Per 1,000 of population.					
1885	29·3	21·8	24·71*	22·74	41·24	31·98
1895	29·1	19·6	34·59	31·39	34·90	29·13
1904	30·7	22·5	42·59	32·45	46·67	34·70
1905	32·0	21·4	39·55	38·63	41·24	44·00

(Figures for 1904 are given because the area of collection in Bengal in 1905 was not the same as in the earlier years, and because the death-rate in the United Provinces in 1905 is exceptionally high.)

It will be observed that in Bengal both birth and death-rates have risen greatly, while in Madras and the United Provinces the increase is comparatively small. In the United Provinces registration in 1885 was fairly good, and little improvement has taken place; in Bengal registration has improved from year to year, and

* For towns only.

in Madras the improvement has been inconsiderable. We may compare these rates with those calculated by Mr. Hardy and published in his actuarial reviews of the census figures of 1881, 1891, and 1901. As registration improves, the registered birth and death-rates will approximate the calculated rates.

Year.	Madras.		Bengal.		United Provinces.	
	Birth-rate.	Death-rate.	Birth-rate.	Death-rate.	Birth-rate.	Death-rate.
	Per 1,000 of population.					
1881	50·4	44·5	47·9	39·9	45·1	41·9
1891	50·3	36·0	51·8	44·8	44·2	37·7
1901	44·8	38·1	43·9	38·9	44·7	43·4

The statement of registration figures shows that in Bengal not only the registered death-rates, but the birth-rates also, increased, and it has been ingeniously argued that the increased birth-rate is only another proof of the impoverishment of the people. This argument is founded upon a proposition that the fecundity of the human animal and of all other living beings is in inverse proportion to the quantity of nutriment available, and that an underfed population multiplies rapidly. Even if this proposition was true the inference that the rising registered birth-rate in India is due to privation is easily demonstrated to be false, unless it is the case that the high Indian marriage-rate is the result, not of religious observance, but of recklessness induced by poverty.

A physiological stimulus must affect the individual, and to sustain the theory that privation causes the high birth-rate in India, Indian women should be exceptionally fertile. This they are not: the average Indian woman is apparently not much more fertile than the average woman in the England of vanishing birth-rates.

Fertility of Indian Women.—In England in 1851 the percentage of all women between the ages of 15 and 45 who were married was 47; this figure rose to 50 in 1871, but it fell again to 47 in 1891, and has not risen again. It is fair to reduce the reproductive period in India by five years, and take the proportion of all Indian women between the ages of 15 and 40, who are married. In India, excluding Burma, in 1891 this was 82·7 per cent. Of every thousand women at the reproductive age only 468 are married in England while 827 are married in India. In England in the sixties the number of legitimate births for every thousand married women at the reproductive age was about 305, in the nineties the figure had fallen to about 262, and in 1901 it had fallen to 235. In India, as the registered birth-rate is below the actual, we may accept the rate deduced by Mr. Hardy, which, including all live births, is 44·4 per thousand of the population. If this rate is correct, the number of children born for every thousand married women at the reproductive period is 273·6.

The high Indian birth-rate, then, is not due to exceptional fertility, but to the large proportion of married women. This has, of course, a bearing upon the high infantile death-rates, for a large proportion of all births must be the first children of youthful parents. The children of young parents are generally weak, and the first child of a marriage is especially exposed to the effects of ignorance and inexperience. The average birth and death-rates in India in Mr. Hardy's opinion do not give any indication of permanent change. A high birth-rate involves either a correspondingly high death-rate or an increase in the population so rapid as to encroach upon the limits of subsistence. The high birth-rate, as we have seen, is the result of the high marriage-rate, which may have been necessary if man was to contend successfully with the adverse physical conditions of his environment. When man in India has learned to protect himself against adverse physical conditions, marriage will be deferred, and the birth-rate, and with it the death-rate, will fall.

The existing system of registration.—The statement on the following page gives details regarding the agencies employed in the collection of vital statistics. It will be observed that, except in Madras and Coorg, the police are employed practically at all stages.

Province.	Collecting and Reporting agency.		Recording Agency.		Collating Agency.		Inspecting Agency.	
	Rural areas.	Town areas.	Rural areas.	Town areas.	Rural areas.	Town areas.	Rural areas.	Town areas.
Assam	Village officials ...	Head of households generally.	The Police station	The Police station, the Magistrate or Municipal office.	The Deputy Commissioner or Sub-divisional officer.		Deputy Commissioner, Sub-divisional officers and the ordinary revenue and police agency. Inspectors of Vaccination are required to test entries in registers.	
Bengal	Village Chaukidars ...	Town Police	Police Station ...	Police Station ...	Civil Surgeon ...	Civil Surgeon ...	The Police and other local officers and the vaccinating staff.	
United Provinces ...	Village Police. In hill tracts village headmen.	Town Police, heads of households and sweepers.	Reporting officers maintain permanent registers.		Civil Surgeons who are generally the health officers.		Revenue and Police officers, officers of the Sanitary and Medical Departments, the vaccinating staff and members of municipal and district boards.	Civil Surgeons generally, and also members of district and municipal boards.
Punjab	Village Chaukidar ...	Municipal Committees responsible. In Municipalities where no byelaws are in force, the beat constable assisted by the mohalla sweepers.	The Police Station	Municipal office ...	Civil Surgeons		Officers of the Sanitary Department, Civil Surgeons, superior police officers, revenue officers and the members of the Vaccination Department.	
North-West Frontier Province.	Village Chaukidar ...	Heads of households	Police Station ...	Municipal office ...	Civil Surgeons		The Revenue Staff under the control of the Deputy Commissioner, the Civil Surgeon and his subordinates including the vaccinating staff, members of municipal and district boards, and local men of position.	
Central Provinces ...	Village watchman (Kotwar).	Heads of households	The Police Stations		Civil Surgeons ...		Revenue and police officers, Civil Surgeons and Superintendents of Vaccination.	
Berar	Headman of village (patel).	Headman of town (patel).						
Madras	Headmen of villages (Kamans).	Heads of households	Headmen (Kamans) who report to the Collectors.	The Municipality...	Collectors and Municipalities who transmit returns to the Sanitary Commissioner.		Collectors and divisional officers, Tehsildars and Deputy Tehsildars, Revenue Inspectors and Deputy Inspectors of Vaccination.	
Coorg	Village headman (patel) managers etc., on coffee estates.	Municipal and Medical authorities.	Officer in revenue charge of a collection of villages.	Municipality ...	The Civil Surgeon		The Commissioner and other superior revenue officers. The Civil Surgeon and the vaccinating staff.	
Bombay	The Police Patel (headman) and the Kulkarni (Acct). Pound Munsiffs and village School Masters are also employed in Sind.	Municipalities ...	The Police Patel or Kulkarni (the Accountant).	Municipalities ...	Deputy Sanitary Commissioner ...		Officers of the Revenue and Sanitary Departments, the latter including the Vaccination Department.	
Burma	Village headman ...	Headmen of wards ...	Village and ward headmen record entries, copies of which are made over to the beat patrol for submission to the police stations		Township officer for submission to the Civil Surgeons.		Township and Sub-divisional officers under control of the Deputy Commissioners.	

If the existing system worked perfectly we should obtain complete information regarding the number and sex of infants born, and the number and sex of the persons that die, and we should have a general idea of the causes of death, but the existing system does not yet work perfectly, and very often the results obtained are misleading. It is evident, moreover, that there is a point beyond which the present system of registration of vital statistics cannot go; however perfectly it may work, it cannot give us accurate details of the causes of death; to obtain this information a professional agency is necessary. It is impossible at present to employ a professional agency, except in the larger towns, and the best way to render the statistics, as at present collected, intelligible seems to be to employ a professional agency in selected areas. The collection of facts in these areas by the existing agency would continue, and the comparison of the statistics collated by the two agencies would give a key to the interpretation of the general statistical returns.

Registration by a Professional Agency.—An experiment on these lines is being carried out in Bengal, in the Galsi *thana* in Burdwan. The following analysis of the registration results collected in August is interesting. There were in all 72 deaths, all of which, except one from malarial fever, had been duly registered in the *thana*. The diseases shown in the *thana* register were fever 52, "other causes" 9, cholera 3, diarrhœa 3, dysentery 2, respiratory disease 1, and measles 1. Enquiry into the real causes of death showed that the entries regarding cholera, diarrhœa, dysentery, and measles were correct, the nine deaths from "other causes" were due to infantile diarrhœa and diseases of newly-born children. The 52 deaths from fever included malarial fever 12, pneumonia 8, diarrhœa 6, tubercle of lungs 5, "senile decay" 4, and single cases of cholera, Brights disease, heart disease, &c.

A similar enquiry is being carried on in one of the Bengal towns.

Revision of forms in use in the great towns.—A Conference, attended by the Medical Officers of Health of Calcutta, Madras, Bombay, and Rangoon, was held at Calcutta in November, 1904, for the purpose of preparing standard forms for the exhibition of vital statistics, &c., in municipal reports. A series of forms drawn up on the lines of the standard forms in use in the provincial sanitary reports was adopted, and the forms have been taken into use.

Births in India in 1905.—The total population of the areas under registration in the Indian Empire in 1905 numbered 223,124,252, but this figure makes no allowance for the natural increase which has occurred since the census was taken in the beginning of 1901. The number of births registered during the year aggregated 8,731,497, as compared with 9,136,536 in 1904, and the general birth-rate in 1905 was 39·13 per thousand or 1·73 per thousand lower than the birth-rate in the previous year. The decrease in the total number of births was due to a decline in the birth-rate in Bengal, Eastern Bengal and Assam, the United Provinces, and Bombay; in all other parts of the Empire, except the Upper Burma towns, where registration is defective, the numbers of births registered were greater in 1905 than in the previous year. The extreme birth-rates were 54·02 per thousand recorded in the Central Provinces and Berar, where the birth-rates of recent years have been extraordinarily high, and 25·31 in the small province of Coorg, where the sex distribution of the population is peculiar and registration is defective. In most of the other provinces, the rates were not far from the mean, those furthest from it being the Punjab and Madras with birth-rates of 44·4 and 32·0 per thousand, respectively. In three provinces the birth-rates were lower than the death-rates, namely, the Punjab where the birth-rate fell short of the death-rate by 3·2 per thousand, and the United Provinces and Coorg where the deficiencies were 2·76 and ·92, respectively. In the 12 towns in Upper Burma the registered death-rate was 2·0 per thousand higher than the registered birth-rate. In the remaining eight provinces the excess of the birth over the death-rates ranged from 16·81 per thousand in the Central Provinces and Berar to 1·02 per thousand in Bengal. The mean number of male births recorded in India generally for every 100 births of females was 106·61. The highest percentages were 122·6 in the North-West Frontier Province, and 116·10 in Ajmer-Merwara and the lowest 95·22 in Coorg; in the other provinces the percentages varied between 109·8 in the Punjab and 103·9 in the Madras Presidency.

Deaths in India in 1905.—The total number of deaths registered was 8,117,771, and the mean death-rate was 35·96 per thousand as compared with 7,436,472 deaths, and a mean death-rate of 32·86 in 1904. In all provinces except Bombay, Madras,

Coorg, the Punjab, and the North-West Frontier Province, the death-rates of 1905 were higher than those of the previous year, the decline in Bombay and the Punjab being due to the abatement of plague, and in Madras, the North-West Frontier Province and Coorg to a decrease under the heading fevers. The highest death-rates were 47·55 per thousand in the Punjab, 44·0 in the United Provinces, and 38·53 in Bengal; and the lowest were 24·93 in Lower Burma, 22·46 in Upper Burma, and 21·4 in Madras. In every province, except Eastern Bengal and Assam, the urban were higher than the rural death-rates.

The highest mortality in India generally occurred in April, and the lowest in July. In most provinces the death-rates of males were higher than the death-rates of females, but in the United Provinces, the Punjab, the North-West Frontier Province, Coorg, and Ajmer-Merwara the female rates were the higher, the excess being most remarkable in the Punjab where plague was most severe.

The death-rates of infants calculated upon the numbers of births and of deaths of infants registered during the year ranged among males and females, respectively, from 301·29 and 270·94 per thousand in the Central Provinces and Berar to 182·43 and 162·99 in Madras. It may be noted that the registered birth-rate was highest in the Central Provinces and Berar, and excepting Coorg, lowest in Madras; and that in the other provinces there is a relation between high birth-rates and high infantile death-rates. In all provinces, with the exception of Coorg, the birth-rates of males were higher than the birth-rates of females, and in all, except the Punjab, the male infantile death-rate was the higher, although in the United Provinces and Ajmer-Merwara the difference between the death-rates of male and female infants was small, and only in the Central Provinces and Berar and Lower Burma was the difference great. Cholera was most severe in Eastern Bengal and Assam (death-rate 4·77 per thousand), Bengal (2·93), and the United Provinces (2·55). Small-pox was present in every province and in five, Lower Burma (1·01), Bombay (·92), Coorg (·73), Central Provinces and Berar (·70), and Ajmer-Merwara (·58), the death-rates were over ·5 per thousand. Plague was absent, or practically absent, from Coorg, Eastern Bengal and Assam, and the North-West Frontier Province, and the plague death-rates were comparatively low in Madras (·2), Upper Burma (·22), and Lower Burma (·55). The mortality in the Punjab (16·65) was more than twice as high as in the United Provinces (8·05) where the next highest death-rate from plague was recorded; in the remaining provinces the plague death-rates ranged from 5·20 in Ajmer-Merwara to 1·07 in the Central Provinces and Berar. The fever death-rates were very low in Madras and Burma, and they were highest in the United Provinces and Bengal. A comparison of the rates registered under fever and "all other causes" in the different provinces shows that they vary inversely, but in most provinces "fever" is credited with the vast majority of all the deaths; in a few the registering agency is more discriminating—or discriminates in a different way. By far the highest death-rates from dysentery and diarrhœa were registered in the Central Provinces (3·02) and Bombay (3·0); in only two other provinces, Lower Burma (1·43), and Madras (1·4) was the ratio more than 1 per thousand, the rates in the other provinces ranging from ·90 in Bengal to ·28 in the North-West Frontier Province.

The death-rates registered as due to respiratory diseases were, in most cases, low, the highest being 3·05 per thousand in the Punjab and 2·95 in Bombay, both provinces where plague was severe.

Bengal.—The weather of 1905 was abnormal, and the climatic conditions were unfavourable to the public health. The early part of the year was exceptionally cold, and the rainfall was excessive; the south-west monsoon rains were not established until the end of June, which was extraordinarily hot, and although the well distributed copious rains of July and August and the very heavy fall in September gave a normal supply to the whole province except Orissa, where the defect was about 20 per cent., the monsoon rains ceased early, October being almost rainless. The late commencement and early cessation of the monsoon rains was unfavourable to many of the crops, and in Bihar the standing crops were damaged or destroyed by floods, the result being that the agricultural outturn was below the average in 23 districts, average in five, and above the average in only three. Owing to the absence of export, however, prices were only slightly raised in Bihar, Chota Nagpur, and Orissa, while they were easier in Lower Bengal.

The total population under registration in the remodelled province is 49,891,164. The number of births registered in 1905 among this population was 1,973,301, or 141,925 fewer than in the previous year, and the birth-rate was 39·55 per thousand against 42·39 in 1904 and a quinquennial mean of 38·91. The highest district death-rates were 51·33, 47·46, and 45·78 registered, respectively, in Palamau, Cuttack and Muzaffarpur, and the lowest, excluding the urban district of Calcutta, where the birth-rate was only 18·44, were 32·84, 32·20, and 30·49, registered in Burdwan, Hooghly and Jessore, respectively. The average recorded birth-rate in rural areas was 40·58 per thousand compared with a mean of 24·53 in the towns in which rates ranged from 65·17 in Jamalpur, 49·48 in Sahibganj, and 47·52 in Lohardaga to 5·28 in South Barrackpore. The explanation of the low rates in towns is the disproportionate male population, the practice of women leaving the towns to be confined at their homes in the districts, and inferior registration. The percentage of males to females was 105, ranging in the districts from 115 in Calcutta and 110 in Howrah to 101 in Gaya, Hazaribagh and Ranchi.

The number of deaths registered was 1,922,369, or 327,849 more than in 1904, and the death-rate was 38·53 per thousand, or 6·58 per thousand higher than in 1904, and 5·11 higher than the mean of the quinquennium. The highest district rates were registered in Gaya, 59·86 per thousand, Patna 58·74, and Shahabad 58·65, all districts in the west of the province where plague was severe, and the lowest in Manbhum 26·23, Ranchi 25·50, and Singbhum 22·05. In rural areas the mean death-rate was 38·42, compared with 40·01 per thousand in the towns, among which enormous rates, such as 92·26 in Daudnagar, in the Gaya District, 87·91 in Gaya town, and 83·46 in Revelganj in Saran, where plague or cholera, or both, were epidemic, are contrasted with rates such as 10·77 in Cossipore-Chitpur, 10·52 in Maniktola, and 7·41 in Ulubaria, where the low rates are evidence rather of defective registration than exceptional salubrity.

The highest mortality in the province as a whole occurred in October, November, and December, and the lowest in June, July, and August.

Among the sects Hindus (39·22 per thousand) and Muhammadans (38·58) had the highest death-rates; the rates among "Other Classes" (27·80), Buddhists (24·66), and Christians (21·66) being much lower.

Infants under one year of age died at the rates of 216·56 and 200·42 per thousand of males and females born, respectively; as usual in Bengal the recorded male rates were the higher at all age periods, the mean death-rate among males being 40·07 per thousand compared with 37·00 among females.

Eastern Bengal and Assam.—The number of the population among whom vital statistics are registered in Eastern Bengal and Assam is, excluding 89,012 in certain hill tracts, 29,812,735. In 1905 there were registered 1,173,879 births, equal to a birth-rate of 39·37 per thousand as compared with 41·68 in the previous year, and 39·53, the mean of the previous five years. As in Bengal, the climatic conditions of the year were unfavourable, and heavy floods in the districts bordering the Brahmaputra and Meghna not only damaged the crops, but apparently led to a severe epidemic of cholera in the last quarter of the year.

The highest district birth-rates were 50·70 per thousand in Goalpara, 48·29 in Malda, and 45·25 in Noakhali; and the lowest were 30·46 in Pabna, 30·06 in Sibsagar, and 28·96 in Kamrup. In rural areas the mean death-rate was 39·72 per thousand, whereas in the towns, in which rates ranged from 69·16 in Barpeta to 1·71 in Jhalakati, the mean was only 23·40. The percentage of male to female births was 106.

The registered deaths numbered 1,045,305, the death-rate being 35·06 per thousand compared with 32·11 among the same population in 1904, and 31·52, the mean of the quinquennium. Among the districts the highest rates were 45·59, 44·45, and 43·88, registered in Pabna, Goalpara, and Malda, respectively, and the lowest were 25·05, 24·77, and 19·99 in Cachar, Sibsagar, and Nowgong. The mean death-rate in rural areas was 35·25, in remarkable contrast to the mean in the towns, where it was only 26·42. The highest urban rates were 55·21 in Barpeta, and 53·44 in Mangaldai, and the lowest 7·27 in Pabna, and 4·77 in Jhalakati. The lowest monthly death-rate was registered in March, 1·97, and the highest rates were registered in November, 4·29, and December, 4·78. Muhammadans died at the rate of 36·38 per thousand, "Other Classes" at the rate of 36·76, while the registered rates among Christians and Buddhists were 25·69 and 18·75 respectively.

Male infants died at the rate of 211·81, and female infants at the rate of 194·59 per thousand born, respectively; at all age periods, except the three between 15 and 40, the male death-rates were the higher—males dying at the rate of 35·86 and females at the rate of 34·22 per thousand.

Tea gardens.—The mean annual strength of the coolies employed on tea gardens in Assam, during the twelve months ending the 30th June, 1906, rose from 660,700 to 670,963. Of the total labour force 38·85 per cent. was employed in the Surma Valley, and 61·15 per cent. in the Assam Valley, the distribution approximating closely to that of the preceding year. The birth-rate showed an increase, being 29·2 per thousand of the total population, and 94·7 per thousand of the female adult population, against 28·4 and 92·1 per thousand respectively in 1904-05. These rates compare unfavourably with the corresponding provincial ratios of 39·37 and 128·4.

The registered death-rate 24·0 per mille was the same as in the previous year, the total number of deaths being 16,103. The principal causes of death were dysentery (2,843), malarial fever (2,429), cholera (2,057), diseases of the respiratory organs (1,933)), diarrhœa (1,607), and anchylostomiasis (1,499). The death-rate among coolies from all recruiting areas, except the Central Provinces, showed a slight increase. The mortality among coolies from those provinces fell from 35·69 per mille to 31·18.

The number of unhealthy gardens, *i.e.*, those with a death-rate of over 70 per mille, was 10 of a total of 757, against 6 of a total of 776 in the year preceding. There were 58 deaths among coolies journeying to the Assam Valley, against 16 in the previous year; 45 of these deaths were due to cholera. Four coolies died of cholera at the Sylhet depôts.

United Provinces.—The climatic conditions of the year were unfavourable; an exceptionally cold and wet spring was followed by very hot weather in May and June; the monsoon rains began late, were in defect in many districts, and ceased to fall before the usual time, except in the Benares division, where the September rainfall was 70 per cent. in excess of the normal. Harvests generally were bad, and prices were high. The number of births registered was 1,967,009, and the birth-rate which had risen to 46·67 per thousand in 1904 as compared with a quinquennial mean of 44·07 fell to 41·24. The highest district rates were 52·59 in Jhansi, 51·44 in Bijnor and 51·32 in Shahjehanpur, and the lowest 32·15 in Ballia, and 31·96 and 27·86 in Naini Tal and Dehra Dun, respectively.

In towns the mean birth-rate was 38·82. Among the towns there were nine, including Kairana (56·26), Chandpur (55·78) and Konch (54·25), in which the birth-rates were over 50 per thousand; in Brindaban (19·81), Naini Tal (15·24) and Mussoorie (9·16) the rates were exceptionally low. The mean percentage of male to female births registered was 108·39.

The registered deaths numbered 2,098,300, or 443,351 more than in 1904, and the death-rate was 44·0 per thousand, nearly 9 per mille higher than the rate of the previous year, 34·70, which was slightly higher than the quinquennial mean, 33·80. By far the highest district death-rate was 91·01, recorded in Muttra where the plague death-rate was 62·64; in the other districts death-rates ranged from 66·58 in Sultanpur, where there was a death-rate from cholera of 25·30 per thousand, and 65·38 in the Ghazipur district of the Benares division, where plague and cholera were severe and fevers exceptionally prevalent, to 26·12 in Almora, the only district in the province in which no death from either plague or cholera was reported. The rural mean death-rate was 43·26 compared with 53·64 in the towns in which, excepting Kiratpur (105·71), where the plague death-rate was 71·82 per thousand, and Brindaban (95·61), where the plague death-rate was 41·51, the death-rate ranged from 86·35 in Muttra to 23·64 in Laharpur.

The highest mortality was recorded in March, 5·07 per thousand, and the lowest, 2·39, in August.

Hindus died at the rate of 44·21 and Muhammadans at the rate of 43·66, "Other Classes" and Christians at the rates of 27·13 and 9·67, respectively.

Infants died at the rates of 264·21 and 261·48 per thousand boys and girls born, respectively. At all age periods except in infancy and after 50 the female death-rates were the higher; females dying at the rate of 45·44 per thousand, compared with a rate of 42·64 among males.

Punjab.—The first three months of 1905 were stormy and exceptionally cold; in April the temperature was comparatively low, but May and June were unusually hot. The rains failed in July and August, but in September a storm gave a very

heavy fall. The temperature of October and November was much higher than usual. The heat and dryness of the summer and autumn were attended by a remarkable reduction in the prevalence of plague.

The number of births recorded was 893,360, and the birth-rate was 44·4 per thousand compared with 41·5 in the previous year and 40·5, the mean of the previous five years. In the districts the highest birth-rates were 67·2 in Lyallpur, 51·2 in Sialkot and 48·5 in Multan; the lowest being 36·2, 35·2 and 21·4 in Ambala, Dera Ghazi Khan and Simla, respectively. The mean rural birth-rate was 44·7 compared with 41·3 in the towns. The percentage of male to female births was 109·8, the district percentages ranging from 118 in Dera Ghazi Khan to 105 in Ludhiana and 104 in Simla.

The number of deaths recorded was 956,108, more than 30,000 less than in 1904, and the death-rate fell from 49·1 per thousand in that year to 47·6, against a quinquennial mean of 44·9. The plague death-rate was 16·7 per thousand, so that, so far as the mortality figures go, the year, but for the presence of plague, would have been an exceptionally healthy one. The highest district death-rates were 78·5 registered in Rohtak, 71·3 in Gurgaon and 66·1 in Amritsar; and the lowest were 25·4 in Dera Ghazi Khan, 25·0 in Simla and 24·5 in Jhang. The mean death-rate in rural areas was 47·37, and the urban rate was 49·13. The enormous death rate of 306·6 was registered in Kangra where 1,374 persons lost their lives as the result of the great earthquake of April, 1905; and in Dharmsala where many people were killed, the death-rate was 90·02. In Sangla, a very small town in Gujranwala, high mortality from plague, cholera, small-pox and fevers gave a death-rate of 129·33 per thousand, and in Hansi, where the plague death-rate was 78·86 per thousand, the total death-rate was 120·86. Death-rates of 104 were registered in Sharakpur and Khudian in the Lahore district; in other towns the death-rates ranged from 81·85 in Bahadurgarh to 7·10 in Khangah Dogran in Gujranwala.

Hindus died at the rate of 51·48 per thousand and Muhammadans at the rate of 44·21; Christians and "Other Classes" (in whose case there are errors in classification) dying at the rates of 24·30 and 54·74, respectively. The highest monthly death-rates were recorded in April, 8·67, and May, 7·35, and the lowest in September, 2·20 and October, 2·37.

Male and female infants died at the rates of 233·90 and 236·31 per thousand born, respectively; and boys and girls over one year and under five years of age died at the rates of 57·39 and 61·42. At all age periods the death-rates of females were the higher, the general death-rate among males being 44·1 and among females 51·6 per thousand.

North-West Frontier Province.—The number of births registered was 70,369 and the birth-rate was 35·4 per thousand, compared with 34·9 in 1904, and the quinquennial mean of 32·3, the general increase in the figures being due to the efforts made to improve registration. The highest district birth-rate was 43·3 recorded in Kohat and the lowest 31·7 in Hazara. The percentage of male to female births was 122·6, the percentages varying in the districts from 134·0 in Peshawar to 114·0 in Dera Ismail Khan. Special enquiries have been carried out during the past few years with the object of ascertaining how far the high recorded proportion of male to female births represented the facts. In 1905 these special enquiries were continued, and two areas were selected, one in the Kohat district containing 30 villages and another in Peshawar containing 159 villages, most of the villagers in both areas being Pathans. The population of the selected area in Kohat was 25,070 (13,514 males and 11,556 females) and during the time of the enquiry the births of 472 males and 428 females were registered by the *chowkidars;* it was found that the births of 43 males and of 40 females had not been registered. The percentage of male to female births according to the *chowkidars'* returns was 110·3, according to the corrected figures it was 110, the mean rate for the whole district being 124·3. The population of the selected area in Peshawar was 79,001 (41,946 males and 37,055 females). The *chowkidars* registered the births of 1,499 males and 1,167 females, a percentage of males to females of 128·4; it was found that the births of 116 males and 101 females had not been registered and when these are included the percentage falls to 127·4, the mean rate for the whole district being 134·0. The results in both areas appear to show that the percentage of male to female births in the frontier districts is really very high, but that registration

is carelessly performed, the fact that lower proportions of male births occurred in the selected areas than in the surrounding districts suggests the possibility of exceptional diligence on the part of the *chowkidars*.

The number of deaths registered was 53,327, and the death-rate was 26·8 per thousand, compared with 28·6 in the previous year and 25·5, the mean of the previous five years. The rates varied in the districts between 27·6 in Peshawar and 24·5 in Bannu, and in the towns between 44·25 in Buffa in Hazara, and 16·77 in Kulachi in Dera Ismail Khan. The death-rate among Muhammadans was 27·23, but they are perhaps less careless regarding registration than the comparatively small number of Hindus, among whom the death-rate was 23·12. Male infants died at the rate of 203·25 and females at the rate of 192·89 per thousand born. In all age periods except under one year, 1—5 and 50—60, the female death-rates were the higher, the general death-rates being 26·2 per thousand among males and 27·5 among females.

Central Provinces and Berar.—The cold weather rains were favourable and but for the extreme cold in February the wheat crop would have been exceptionally good. The monsoon rains were late and the fall was defective until the heavy rain of September to which the prevalence of malarial fevers is attributed. The autumn crops were abundant. The year was unhealthy, and influenza, malarial fevers and bowel complaints were rife.

The number of births recorded was 642,199 and the birth-rate was 54·02 per thousand against 53·19 in 1904. In the districts of Yeotmal, Damoh and Murwara, the high birth-rates of 61·24, 60·00 and 59·86 were recorded, while the lowest rates in the province were comparatively high—48·69 in Hoshangabad, 48·57 in Amraoti and 46·30 in Burhanpur, the only district in which the births were fewer than the deaths. In rural areas the mean birth-rate was 55·34 compared with 42·37 the urban mean. The provincial percentage of male to female births was 104·38, varying in the districts between 108·91 in Nagpur and 102·14 in Raipur.

The registered deaths numbered 442,383, and the death-rate was 37·21 per thousand, compared with 32·06 in the previous year. The highest district death-rates were 54·80 recorded in Burhanpur and 50·08 in Buldana; in the other districts the rates ranged from 47·19 in Nimar to 28·44 in Mandla. In rural areas the mean death-rate was 36·69 as compared with 41·87, the mean in the towns, among which very high rates were registered in Mohgaon (127·05), a small town which suffered severely from plague, in the Chhindwara district, in Nandura (93·12) and Deulgaon Raja (89·15), small towns in the Buldana district, where plague was very severe in both town and country. In the remaining towns the death-rates ranged from 82·68 in Akote to 17·07 in Rajim.

The infantile death-rate was 301·29 among males and 270·94 among females per thousand born, respectively. Males of all ages died at the rate of 39·35 and females at the rate of 35·12 per thousand of the census population.

Madras.—The rainfall in the presidency in 1905 was about three and a half inches below the normal, but the rainfall of both monsoons was irregularly distributed and the prices of food grains, which had risen on account of the failure of both the south-west and north-east monsoons in 1904, rose still further.

The total number of births recorded was 1,176,256, equal to a birth-rate among the population of 36,737,533 under registration of 32·0 per thousand—the highest rate yet reached excepting the year 1891 when it was 32·4—as compared with 30·7 in 1904 and 29·4, the quinquennial mean. Excluding the urban district of Madras, where the birth-rate was 46·0 per thousand, the district rates ranged from 38·7 in Guntur to 24·4 in Nellore. The mean rural birth-rate was 31·6 against 35·1 in the towns in which rates varied between 61·2 in Vaniyambadi and 6·5 in Madanapalli in Cuddapah.

The percentage of male to female births was 103·9, the district percentages ranging from 107·7 in the Nilgiris to 101·5 in Anantapur.

The deaths registered numbered 786,123 and the death-rate was 21·4 per thousand against 22·5 in the previous year, and 21·9 the average of the previous five years. Again excluding Madras, where the death-rate was 59·5 per thousand, the district rates ranged from 31·4 in Bellary to 16·0 in North Arcot. In rural areas the mean death-rate was 20·3, while in the towns the mean was 29·6, the extreme rates being 92·2 in Kampli in Bellary and 5·6 in Rajampet in Cuddapah.

Muhammadans and Hindus died at the rates of 23·3 and 21·4, respectively; Christians and "Other Classes" at the rates of 17·2 and 9·2.

Male infants died at the rate of 182·43 per thousand born, female infants at the rate of 162·99. In the three age periods between 10 and 30 the female death-rates were the higher, in all other age periods males died at the higher rates, the general death-rates being 22·2 and 20·6 per thousand among males and females, respectively.

Coorg.—There were 4,572 births registered in Coorg in 1905 equal to a birth-rate of 25·31, as compared with 21·97 in the previous year and 23·28 the mean of the previous five years. The district rates varied between 38·15 in Padinalknad and 19·90 in Yedenalknad, the mean percentage of male to female births being 95·22.

The number of deaths registered was 4,739 and the death-rate was 26·24, against 26·62 in 1904 and a quinquennial mean of 31·30. The highest district death-rate was 30·74 in Nanjarajpatna, the lowest 23·66 in Kiggatknad; the mean urban death-rate was 32·13, the mean rural rate, 25·70. Male and female infants died at the rates of 222·42 and 209·22 per thousand born, respectively. In all age periods, except the four from 10 to 40, the male death-rates were the higher, but the general death-rate of males was 25·70 as compared with 26·91 among females.

Bombay.—The number of births recorded in the Bombay Presidency fell from 648,594 in 1904 to 611,173 in 1905, and the birth-rate from 35·09 to 33·07 per thousand, which, however, is considerably higher than the quinquennial mean, 30·51. The highest district birth-rates were 46·63, 45·09 and 43·12 registered in Khandesh, Broach and Panch Mahals, respectively, and the lowest were 19·67, 19·04 and 17·88 in the Sind districts of Upper Sind Frontier, Hyderabad and Thar and Parkar. The mean birth-rate in rural areas was 34·07; the mean of the urban rates was much lower, 26·42 per thousand, the highest rates being 51·60 in Karachi, 51·43 in Dholka in Ahmedabad and 44·29 in Athni in Belgaum. The percentage of male to female births in the presidency generally was 108·44, but in the districts of Bombay proper the percentages varied between 111·72 in Kaira and 102·43 in Panch Mahals, while in the Sind districts, excluding Karachi where the percentage was 114·5, the percentages ranged from 135·81 in Hyderabad to 121·13 in Sukkur.

There was a most gratifying decline in the mortality, the number of deaths falling from 764,914 in 1904 to 588,394 in 1905, and the death-rate from a mean of 46·31 in the previous five years and 41·39 in 1904 to 31·84. The fall in the mortality was due to the abatement of the plague, the recorded deaths falling by 152,594 from 223,957 in 1904 to 71,363. The highest district death-rate was, excluding 62·33 in Bombay City, 41·13 in Ahmedabad; in the remaining districts the rates ranged from 40·10 in Khandesh to 15·88 in Hyderabad. In rural areas the mean death-rate was 29·47 compared with 47·59 in the towns, among which the highest rates were 65·24 in Shikarpur, 63·43 in Ahmedabad, towns in which small-pox and diseases recorded under the heading "fevers" were exceptionally severe, and 63·05 in Yeola, a small town in Nasik, where the plague mortality was 38·41 per thousand.

Hindus died at the rate of 34·0 per thousand, followed by Jains, 28·80, Parsis 24·26, Muhammadans 23·98, and Christians 22·76. The high rate recorded for "Other Classes," 48·18, is dependent upon errors in classification.

The death-rate of male infants was 229·52 and of female infants 219·07 per thousand born, respectively. In all age periods except 5—10, 10—15, 15—20 and 20—30 the male death-rates were the higher, the means being 32·11 among males and 31·54 among females.

Lower Burma.—The number of births registered in Lower Burma in 1905 was 191,226, about 11,200 more than in the previous year, and the birth-rate rose from 32·71 per thousand to 34·34 as compared with the quinquennial mean of 33·46. In the districts, excluding Rangoon, the rates ranged from 42·73 in Thayetmyo to 27·72 in Toungoo, the mean percentage of male to female births being 106.

The registered deaths numbered 138,850 and the death-rate which was 22·36 per thousand in 1904, as compared with a mean of 23·17 in the five years ending with 1904 rose to 24·93. Excluding the urban district of Rangoon, where the death-rate was 45·90, the district rates varied between 28·99 in Henzada and 15·59

in Thaton. In rural areas the mean death-rate was only 23·0 as compared with 38·21 in the towns, among which Wakema (54·53), Kyaiklat (53·05) and Henzada (49·32), in the Irrawaddy division, where cholera and small-pox were severe, suffered the heaviest mortality.

The death-rate among Hindus was 32·03, among Burmese 24·87, among Muhammadans 22·99, among Christians 15·36, and among "Other Classes" 26·90.

The infantile death-rate was 220·17 for males and 171·64 for females per thousand born, respectively. In all age periods the male death-rates were the higher, the general death-rate for males being 26·43 and for females 23·24.

Upper Burma.—The registration of births in Upper Burma is limited to twelve towns, but will become general from 1st January, 1907. The mean birth-rate in the twelve towns fell from a quinquennial mean of 37·03 per thousand and 35·05 in 1904 to 34·91 in 1905 the rates ranging in the individual towns from 50·33 in Taungdwingyi to 29·09 in Shwebo; and the percentage of male to female births ranged from 112 in Pakokku to 79 in Salin.

The total number of deaths recorded was 65,541, and the death-rate rose from 18·69 to 22·46 as compared with a quinquennial mean of 19·63. The district death-rates varied greatly from 30·49 in Kyaukse to 15·41 in Meiktila. The rural death-rate was 20·87, while the mean rate in the towns was 36·56, the rates ranging in individual towns from 62·55 in Pakokku, where cholera was severe, 50·53 in Pyinmana, where plague was epidemic, and 49·07 in Myingyan, which suffered from cholera, to 24·08 in Yamethin.

The Burmese death-rate was 22·46, as compared with 22·12 among Hindus, 23·25 among Muhammadans and 13·36 among Christians.

The defective registration of births renders an estimate of the infantile death-rate impossible. At all age periods, except 30—40, the male death-rates were the higher, the general death-rate being among males 23·64 and among females 21·40 per thousand.

Ajmer-Merwara.—The number of births recorded rose from 15,997 in 1904 to 17,802, and the birth-rates from a quinquennial mean of 26·38 and 33·54 in 1904 to 37·32 per thousand in 1905, the rate being 45·70 in Merwara and 34·84 in Ajmer. The percentage of male to female births was 112·16 in Merwara and 117·66 in Ajmer.

The number of deaths registered was 16,332, or 3,183 more than in the previous year, and the death-rate was 34·25 compared with 27·57 in 1904 and a quinquennial mean of 51·75. The death-rate in Ajmer, where plague was widespread and gave rise to a death-rate of 6·51, was 36·32 per thousand, against 27·25 in Merwara. Plague was very severe in the small town of Kekri where the death-rate from all causes was 105·20. In Ajmer suburb the total death-rate was 67·72, including 7·12 from plague and 2·99 from small-pox. The Hindu and Muhammadan death-rates were, respectively, 35·98 and 35·53 per thousand.

The death-rates of infants were 234·32 among males and 232·94 among females per thousand born, respectively. In the five age periods between 1 and 30 the female death-rates were the higher, the general rates being among males 33·66 and among females 34·90 per thousand.

LIBRARY OF THE BOMBAY BRANCH OF THE ROYAL ASIATIC SOCIETY

History of the Chief Diseases.

(For Statistical Tables, *see* pages 144 to 148.)

Mortality from Chief Diseases.—The following statement gives a tabular view of the number of deaths from, and the death-rates per 1,000 of population for each of the chief diseases and all causes recorded in British territory in India during each of the five years, 1901-5. It will be seen that the year under review was

Years.	Cholera.	Small-pox.	Fevers.	Dysentery and Diarrhœa.	Plague.	All Causes.
1901	271,210	89,385	4,174,919	247,190	237,688	6,606,387
	1·21	·40	18·62	1·10	1·06	29·46
1902	224,136	115,443	4,279,351	235,750	456,975	7,112,336
	·99	·51	18·95	1·04	2·02	31·49
1903	312,854	93,693	4,459,237	273,459	686,485	7,881,125
	1·38	·41	19·66	1·21	3·03	34·7
1904	192,835	55,232	4,093,981	240,655	940,609	7,436,472
	·85	·24	18·09	1·06	4·16	32·86
1905	441,786	70,962	4,417,655	264,124	940,821	8,117,771
	1·96	·31	19·57	8·17	4·17	35·96

exceptionally unhealthy; the death-rate (35·96) is the highest in the quinquennial period. Compared with the previous year, 681,299 more deaths were recorded, and there was an increase in the mortality under each heading, this increase being least significant (·01 per mille) in the case of plague: compared with the preceding years of the quinquennium, the mortality from cholera, from plague, from fevers and from dysentery and diarrhœa has been excessive; the death-rates from cholera and plague are the highest in the quinquennium, and the death-rates for fevers and dysentery and diarrhœa are second only to the death-rates from these causes in 1903. Fevers accounted nominally for more than 54 per cent. of the deaths from all causes.

Cholera in India in 1905.—The number of deaths from cholera recorded in British territory during 1905 was 441,786, equal to a death-rate of 1·96 per 1,000 of the total population under registration. If the deaths recorded in the native States from which returns were received are added, the total amounts to 442,506. In the previous year 192,835 deaths from cholera were recorded in British territory, giving a ratio of ·85 per 1,000 of population, so that during the year under review cholera was considerably more than twice as prevalent as in the previous year. This increase in mortality during 1905 was shared by all the British provinces except Ajmer-Merwara and Coorg, both of which have now remained free from the disease for three year in succession. The greatest numbers of deaths from the disease during the year were recorded in Bengal, Eastern Bengal, and Assam, the United Provinces and Madras, the figures requiring special notice being 142,312 deaths reported from the new province of Eastern Bengal and Assam and 121,790 deaths reported from the United Provinces as compared with 6,617 from the same province in 1904. The highest death-rates were recorded in Bengal, Eastern Bengal and Assam, the United Provinces and Lower Burma, and in all these provinces cholera was present throughout the year. The seasonal prevalence varies widely—not only in the different provinces in the same year, but also in the same province from year to year. In Bombay the greatest number of deaths occurred in June as compared with August in 1904; in Madras in August as compared with January in 1904; in the Punjab, the North-West Frontier Province and the Central Provinces in September as compared with June, July, and August, respectively, in 1904; in Lower Burma in October as compared with April in 1904, in Bengal and the United Provinces in November as compared with December and June, respectively, in 1904; in Eastern Bengal and Assam in December, the same month as in 1904. In Bengal during 1905, fewest deaths occurred in the month of June, while in September and October, the two months during which the disease is usually least prevalent, a heavy incidence was recorded.

Cholera.—Recent Investigations.—In last year's report a reference was made to investigations, carried out in the early part of 1905 by Dr. F. Gotschlich at the pilgrim

quarantine camp at Tor, relating to the finding of vibrios in the intestines of 38 pilgrims (107 cadavers examined) who had died from dysentery and other forms of colitis while on their return journey from the Hejaz. Six of the 38 vibrio strains were found by Gotschlich to be identical with the vibrio of true Asiatic cholera not only culturally and morphologically but also according to the agglutination and Pfeiffer reactions; and yet (1) there was no evidence, clinical or pathological, that the pilgrims from whose intestines these six vibrio strains were isolated had ever suffered from cholera, and (2) no case of cholera was known among the pilgrims visiting Mecca during that season, so these six pilgrims had not infected others. Gotschlich regarded the six pilgrims, who all came from regions in which cholera is reputedly endemic, as cholera vibrio "carriers" and stated that the absence of an outbreak of cholera among the pilgrims might possibly have been due to the vibrios being (*a*) eliminated only in small numbers and (*b*) perhaps of low virulence. The other 32 strains were isolated from the intestines of pilgrims of diverse nations and were easily distinguished from Koch's cholera vibrio; they were in all probability derived from the drinking water—in the water of the holy well in the Kaaba at Mecca saprophytic vibrios were found. It is interesting to note that during the pilgrim season 1905-6 there was again a complete absence of cholera among the returning pilgrims but in two cases a vibrio identical with the above six strains was isolated at the Tor quarantine camp. Gotschlich examined the fæces of 127 pilgrims in hospital for various diseases and found vibrios in 18. No reaction with cholera serum (obtained from Berlin) was given by 16 of these 18 strains even in a dilution of 1 in 50, while the specific reaction in a dilution of 1 in 2,000 was given by the other two. The Tor vibrios have occasioned a great deal of work with the object of ascertaining whether they are real cholera germs or not. The matter is not yet settled.

Cholera in Bengal.—In Bengal in 1905 the total number of deaths recorded as due to cholera was 146,339 or 2·93 per mille of the population as compared with 81,463 or 1·63 per mille in 1904, and 138,577 or 2·77 per mille—the average figures for the five years 1900-4. The mortality during 1905 was higher than in any of the previous eight years except 1900. No district was entirely free from the disease which attacked 18,652 villages and assumed an epidemic form in 104 registering circles, as compared with 14,241 villages, and 45 registering circles in 1904. The district of Gaya in the Patna division suffered most severely and lost from this cause 6·63 per mille of its population. Other districts in which a high mortality from cholera was recorded were Purnea (5·17 per mille), Patna (5·0 per mille), Shahabad (4·94 per mille), Howrah (4·78 per mille), Bhagalpur (4·74 per mille), and Puri (3·97 per mille). Ranchi and Palamau, which remained free from this disease in 1904, were the least affected of all the districts during the year. Compared with the previous year, the mortality from this cause was smaller in only eight districts, the most important of these being Singhbhum, Darjeeling, Hazaribagh, and Manbhum. The great prevalence of the disease in Gaya is said to have been due to the contamination of the wells by surface washings in consequence of a very heavy continuous rainfall directly after excessively dry weather. Considering the province as a whole, the incidence was greatest during the last four months of the year and least during May and June.

The highest death-rates for cholera recorded in towns were 12·94 per mille in Gaya, 11·99 in Puri, 11·54 in Buxar, 11·49 in Tikari, and 10·10 in Chapra. Among rural areas, the highest rates were recorded in Kadwa (16·23 per mille) and Kasba Amur (14·89 per mille), both in Purnea.

In the district of Gaya over 6,900 wells were disinfected with permanganate of potash, and the disease is said to have been thus kept in check. This method of purifying well-water was also applied in 16 other districts; from Champaran the statement comes that good results followed its use.

Among the European seamen of the port of Calcutta there was only one death from cholera: there were 33 among the native floating population.

Cholera in Eastern Bengal and Assam.—The number of deaths attributed to cholera in the new province of Eastern Bengal and Assam during 1905 was 142,312, equal to a ratio of 4·77 per 1,000 of the census population. The average death-rate for cholera during the decade 1895-1904 for the combined districts which now constitute the province of Eastern Bengal and Assam was 2·30 per mille, which is less

than half the mortality during the year under review. The provincial sanitary commissioner remarks that in some cases there was a history of the disease spreading from village to village along the course of the streams and rivers, especially where the people relied on the river water for household purposes. From October to December the disease raged in most of the districts bordering on the lower reaches of the Brahmaputra and Ganges; the districts of Mymensingh (10·5 per mille), Kamrup, Goalpara, Bogra, and Pabna, all returned death-rates above 7 per mille: in these five districts during the last three months of the year the epidemic was sufficiently severe to interfere with business. In some places the villagers were unable to dispose of their dead in the ordinary way and either threw the bodies into the rivers to be carried away by the flood or left them to rot on the surface of the ground. On the other hand, districts on the upper reaches of the Brahmaputra and districts having little or no connection with the great water-ways suffered only to a small extent. In Mymensingh, which suffered most severely during the year, the decennial rate was only 2·18 per mille; Kamrup is the district which showed the highest decennial death-rate (5 per mille). In Dacca, wells and tanks in the affected localities were subjected to the permanganate of potash treatment, and it is reported that the disease was brought under control almost immediately after this treatment was begun.

The towns which recorded death-rates over 10 per mille were Tangail, Sherpur, Sibsagar, and Bogra: the quinquennial death-rate for cholera in Tangail is 13·8 per mille of the population, while the quinquennial rate for no other town in the province is over 4 per mille.

The death-rate (2·14 per mille) from cholera among tea-garden coolies was much less than that among the general population of the province, the highest coolie death-rate being 2·69, recorded in the Sylhet district. Other districts returning rates over 2 per mille were Cachar, Kamrup, and Lakhimpur. Altogether there were reported 391 cases, of which 252 occurred in the Karimganj Sub-division.

Cholera in the United Provinces.—The total number of deaths from cholera recorded in the United Provinces during 1905 was 121,790, equal to a ratio of 2·55 per 1,000 of population, as compared with a total of 6,617 and a ratio of ·14 during 1904. The average death-rate of the preceding quinquennium was ·92 per mille. Of the 48 districts no death from cholera was reported during the year in six, and not more than nine deaths in any of ten other districts. The districts where the mortality from this cause was highest were Sultanpur (25·30 per mille), Partabgarh (12·14), Fyzabad (10·63), Rai Bareli (10·55), Bara Banki (8·44), and Basti (6·85); of these six districts, the first three mentioned and Bara Banki are in the Fyzabad division.

The highest death-rates for this disease recorded in towns were 13·48 per mille at Jais (Rai Bareli), 13·32 at Radauli (Bara Banki), 10·75 at Ramnagar (Benares), 9·55 at Barhaj (Gorakhpur), 6·42 at Azamgarh, and 6·29 at Sandila (Hardoi). Of the 107 towns with populations of 10,000 or more, 61 did not return any death from this cause.

No case of cholera was reported to have occurred at the Dikhauti and Mahavaruni fairs at Hardwar, the Garhmuktesar fair at Meerut, the Batesar fair at Agra and the *Magh mela* at Allahabad. During the time of the Dadri fair at Ballia, cholera was present in Ballia and the neighbouring districts, yet only 56 cases with 45 deaths occurred among the multitude, numbering about 700,000, that attended this festival on the principal bathing day.

Cholera in the Punjab.—In the Punjab cholera did not assume a severe epidemic form during the year. The total number of deaths was 2,197, yielding a ratio of ·11 per mille of population as against ·04 in the previous year and ·41—the average of the quinquennial period ending with 1904. The largest number of deaths amounting to 1,624 or three-quarters of the total registered in the province occurred in the district of Lahore, Multan coming next with only 141 deaths. No death from cholera was reported to have occurred in the province during the first four months of the year, and only 13 and 36 deaths were recorded in May and June, respectively; but the number of deaths registered in July, August, and September amounted to 87 per cent. of the total number of deaths from cholera during the year in the province. Of the 145 municipal towns in this province, cholera was reported from only 26; the highest death-rates recorded in towns were 13·78 per

mille of the population in Shujabad (Multan), 6·11 in Sangla (Gujranwala), 4·13 in Chunian, 2·86 in Kasur, 1·95 in Lahore, and 1·81 in Khem Karn (the last four towns are in Lahore district).

On the appearance of cholera in any locality, the sources of drinking water open to contamination were disinfected with permanganate of potash.

Cholera in the North-West Frontier Province.—In 1904 the North-West Frontier Province was practically free from cholera, only one death having been reported from a village in the Hazara district; in 1905 in the same district the disease prevailed in epidemic form during September and October, 415 cases with 303 deaths having been registered. Evidence seems to point to infection having been conveyed to a village in this district by a man who had come from Lahore, where the disease was at the time prevalent; from this village infection rapidly spread to neighbouring villages and towns. The civil surgeon reported that "the people were generally apathetic and, in some cases hostile" to the prophylactic measures adopted. There was not a single death from cholera during the year in any other district in the province.

Cholera in the Central Provinces and Berar.—In the Central Provinces and Berar the total number of deaths recorded in 1905 as due to cholera was 1,217, or ·10 per mille of the population, as compared with a total of 2,967 and a ratio of ·24 in 1904. During 1905 the disease was confined to the districts of Bilaspur (605 deaths), Raipur (382 deaths), Jubbulpore (136 deaths), Narsinghpur (60 deaths), Wardha (23 deaths) and Chanda (10 deaths). The disease is said to have been introduced by infected pilgrims returning from Puri (Jagannath). The highest district death-rates were ·55 in Bilaspur, ·26 in Jubbulpore, and ·25 in Raipur.

With the exception of one doubtful case reported from Yeotmal, there was no cholera in the Berar districts during the year.

Cholera in the Madras Presidency.—In the Madras Presidency in 1905 there were 16,888 deaths recorded as due to cholera, giving a ratio of ·5 per mille of population, as compared with a total of 23,109 and a ratio of ·6 per mille in 1904. The ratio for the year under review is the lowest since 1895. The disease was reported from all the districts of the presidency except the Nilgiris, Tinnevelly and Coimbatore (the last mentioned registered one case). The highest death-rates recorded in districts were 7·2 per mille in Madras, 2·8 in Bellary, 1·8 in Chingleput, 1·3 in Nellore, 1·2 in Kistna, and 1·1 in Godaveri.

The highest death-rates for cholera recorded in towns were 16·1 in Pulicat (Chingleput), 7·7 in Kampli (Bellary), 7·2 in Madras, 6·8 in Bezwada (Kistna), 6·0 in Dowlaishweran (Godaveri) and 6·6 in Nellore. In Madras the disease broke out in a severe form about the beginning of the latter half of the year and accounted for 3,534 deaths. The cause of the outbreak was supposed to be due to the use of "polluted sources of water-supply when the Red Hills' supply ran short of requirements."

Water-disinfection by permanganate of potash was, as usual, carried out in the areas invaded by cholera and was found to yield good results.

Cholera in Coorg.—During 1905 no death from cholera was recorded in Coorg. This small province has been free from the disease since 1901, in which year 58 deaths from this cause were reported.

Cholera in the Bombay Presidency.—In the Bombay Presidency there were recorded during 1905 as due to cholera 5,396 deaths, equal to a ratio of ·29 per mille of population, as compared with 13,156 deaths or a ratio of ·71 per mille in 1904. The disease was practically confined to the southern registration district, where 5,318 deaths, *i.e.*, 98·55 per cent. of the total number of deaths in the presidency, were recorded. The highest death-rates for this disease recorded in districts were 2·02 per mille of population in Bijapur, 1·91 in Dharwar, and 1·60 in Belgaum; outside these districts the incidence of cholera was very slight, Sind and Gujarat, with the exception of one doubtful case reported from Ahmedabad district, remaining free from the disease throughout the year.

Deaths from cholera were recorded in 11 of the 56 town-circles in the presidency as compared with 25 town-circles in 1904, the highest rates being 6·26 in Gadag-Bettigeri (192 deaths), 4·71 in Bijapur (112 deaths), 4·46 in Gokak (44 deaths), 2·79 in Kalyan (30 deaths), and 1·70 in Dharwar (52 deaths).

The acting deputy sanitary commissioner reported in connection with the epidemic in the southern registration district: "During the year cholera has attacked most severely the towns and villages on the banks of rivers and streams. This probably has relation to density of population and to favourable conditions of soil (porosity and moisture) as well as to the rivers or streams acting in the dual capacity of sewers and sources of drinking-water."

Cholera in Burma.—In Lower Burma during 1905 there were recorded as due to cholera 3,511 deaths, equal to a ratio of ·63 per mille of population, as compared with 2,472 deaths or ·45 per mille for the same cause in 1904. The highest death-rates recorded in districts were 4·11 per mille of population in Mergui (365 deaths), 1·61 in Kyaukpyu (272 deaths), 1·58 in Tharrawaddy (624 deaths), and 1·19 in Maubin (337 deaths); in towns the highest death-rates were 8·98 in Minhla, 6·16 in Letpadan, 5·41 in Kyaukpyu, and 5·02 in Kyaiklat.

In Upper Burma the total number of deaths recorded during 1905 as due to cholera was 1,836 as compared with 508 during 1904. The disease prevailed in every district except one—Yamethin; the highest mortality was recorded in Myingyan (1·59) and Pakokku (1·14), where 567 and 343 deaths, respectively, occurred. The highest death-rates recorded in towns were 9·10 in Pakokku, 6·23 in Minbu, 5·89 in Myingyan, and 5·46 in Monywa.

The provincial sanitary commissioner reports that in Lower Burma there was a decline of incidence during the heaviest part of the monsoon, namely, June, July, and August; whereas in Upper Burma the prevalence of the disease increased throughout the monsoon months. He expresses the opinion that the heavy rainfall of Lower Burma served to dilute, if not completely change contaminated water sources, while in Upper Burma the relatively small rainfall served to scatter the cholera virus without causing effective dilution or flushing of water sources by storm water.

Cholera in Ajmer-Merwara.—During 1905 no death from cholera was recorded in Ajmer-Merwara. This small province has now been free from the disease for three years in succession; 32 deaths were reported in 1902.

Small-pox.—From the statement in the first paragraph of this section it will be seen that in British territory in India the death-rate per 1,000 of population on account of small-pox rose from ·24 in 1904 to ·31 in 1905, the latter ratio, however, being lower than that of any of the three years 1901 to 1903. The mean ratio for the quinquennial period ending 1904 was ·40 per mille. The total number of deaths from this disease recorded during 1905 was 70,962 against 55,232 in 1904, and 93,693 in 1903. In all provinces except the Bombay Presidency and Lower Burma, the death-rates during 1905 were lower than the corresponding means of the quinquennium 1900-4; the greatest falls in the death-rates were recorded in Ajmer-Merwara, the North-West Frontier Province and Bengal. As compared with 1904, a year in which the incidence was exceptionally low, the death-rate during 1905 showed an increase in all provinces, except Bengal, Eastern Bengal and Assam, the United Provinces, Punjab, and the North-West Frontier Province—the increase being greatest in Lower Burma and the Bombay Presidency. The small-pox mortality in towns was nearly three times as heavy as that in rural areas; and the deaths of children under ten years of age amounted to 72·52 per cent. of the total number of deaths from this disease (in Burma alone was this percentage under 50).

In Bengal the number of deaths from small-pox fell from 11,090 (·22 per mille) in 1904 to 7,213 (·14 per mille) in 1905; the mean death ratio during the quinquennial period ending 1904 was ·54 per mille. As compared with 1904, the incidence of the disease was lower in 24 districts and higher in seven; Puri and Murshidabad were the districts most affected. The civil surgeon of Puri attributes the great prevalence of small-pox in that district to the backward uneducated state of the people; the civil surgeon of Murshidabad states that most deaths from this cause occurred in villages largely inhabited by Ferazi Muhammadans, who have for years resisted all attempts at vaccination. Only one town—Kishanganj in Purnea—suffered severely from this disease.

In Eastern Bengal and Assam during 1905, small-pox was the cause of 4,723 deaths, yielding a death-rate of ·15 per mille of population as compared with ·26 in 1904 and ·27—the mean ratio for the quinquennium ending 1904. The highest

rates in districts were 2·78 per mille in Kamrup and 1·11 per mille in Darrang. In the former district the disease occurred chiefly among the Mahapurushiyas who do not, for religious reasons, accept vaccination. In the town of Barpeta, the headquarters of this sect, the death-rate recorded was 3·54 per mille.

In the United Provinces 3,273 deaths were attributed to small-pox in 1905 as compared with 6,998 in 1904 and 21,950 in 1903, the corresponding rates being ·07, ·15, and ·46 per mille. The average rate for the quinquennial period 1900-4 was ·15. Eight districts were practically free from the disease during the year: the highest death-rate in districts was 1·44 per mille, recorded in Jhansi. Out of 107 towns having a population of 10,000 and upwards, only 33 furnished deaths from this cause and in none of them except Benares (where the rate was ·61 per mille) did the number of deaths exceed ten.

In the Punjab there were reported during 1905 as due to small-pox 4,723 deaths, equal to a ratio of ·23 per 1,000 as compared with 9,624 deaths and a ratio of ·48 per 1,000 in 1904. The average death-rate during the quinquennial period ending 1904 was ·52 per mille. The highest rates in districts were ·89 per mille in Ludhiana (598 deaths), ·76 in Ferozepore (708 deaths), ·68 in Lahore (783 deaths) and ·55 in Montgomery (268 deaths). The rate was only ·01 per mille in the three districts—Kangra (nine deaths), Jhang (six deaths) and Attock (five deaths). The highest death-rates in towns were recorded in Ludhiana (9·09 per mille) and Pakpattan (5·17 per mille). The municipal committee of Ludhiana has resolved to introduce the Vaccination Act into their town; the towns in which the Act was in force recorded a death-rate of ·36 as compared with a rate of ·82 in towns where vaccination was not compulsory.

In the North-West Frontier Province the number of deaths from small-pox fell from 2,694 in 1903 and 1,561 in 1904 to 571 in 1905, the ratios being 1·35, ·78, and ·29 per mille, respectively. Out of the 571 deaths no less than 374 occurred in the district of Hazara and 182 in that of Peshawar; no death from this disease was recorded in the district of Bannu. In the three towns Bannu, Kohat, and Dera Ismail Khan, in which the Vaccination Act was in force, there was very little small-pox.

In the Central Provinces and Berar there were recorded, during the year, 8,364 deaths from small-pox against 2,026 in 1904. The increase is attributed by the provincial sanitary commissioner to less vaccination during recent years owing to the presence of plague. The largest number of deaths were reported in the Buldana (1,483), Nagpur (1,398), and Saugor (1,114) districts. It is, however, suspected that many deaths from this disease were concealed or returned as chicken-pox or measles.

In the Madras Presidency small-pox accounted for 18,540 deaths against 9,891 in 1904. Cases were reported from all the districts in the presidency, but the fatality from this disease was greatest in Madura and Bellary, in each of which a rate of 1·5 per mille was recorded. Of the 61 municipal towns of this presidency, 23 enjoyed immunity; the remaining 38 returned 2,709 deaths, the highest rate being 8·0 per mille in Dindigul. The provincial sanitary commissioner urges compulsory vaccination in rural areas.

In the Bombay Presidency the number of deaths from small-pox recorded in 1905 was 16,985 (·92 per mille) as compared with 4,289 (·23 per mille) in 1904. The mean ratio for the quinquennial period ending 1904 was ·26 per mille, which is ·66 per mille less than the rate for the year under review. The mortality during 1905 was the highest recorded during the past 27 years. The disease was prevalent in every district and deaths were reported from 226 registering circles out of a total of 287. The districts of Khandesh and Bombay contributed 7,694 and 2,148 deaths, respectively, the two combined thus accounting for much more than half the total number of deaths in the presidency; the death-rates in this districts were 5·39 and 2·82 per mille, respectively. A notable feature was the high mortality among children under one year of age, amounting to nearly 36 per cent. of the total number of deaths.

In Burma there was a considerable increase of prevalence of small-pox during the year, the total number of deaths being 6,161 against 1,809 in 1904. Lower Burma was chiefly affected, its death-rate being 1·01 per mille of the census population as compared with ·24 in 1904 and a mean of ·36 for the quinquennium ending 1904. In Upper Burma the increase was very slight, namely, ·18 against ·17 in 1904: it should be noted, however, that the mean in Upper Burma for the preceding

quinquennium was ·41, which is more than twice as high as the rate for 1905. In Rangoon and in the Pyapon and Hanthawaddy districts, all in Lower Burma, the heavy rates of 2·98, 2·79, and 2·32 per mille, respectively, were recorded.

In Ajmer-Merwara 277 deaths (·58 per mille) from small-pox were recorded during 1905 as compared with 129 (·27 per mille) in 1904. In Coorg the number of deaths reported as due to this disease was 132 against 16 in the previous year.

Plague.—The number of deaths recorded as due to plague in the Indian Empire in 1905 was 1,069,140, compared with 1,143,933 in the previous year. In the British provinces there was a slight increase, the registered deaths numbering 940,821 or 2,811 more than in 1904; but there was a remarkable change in the course of the epidemic. In each of the first five months of 1905, the number of deaths was considerably greater than in the corresponding months of 1904, but from June onwards this relation was reversed, and the number of deaths in the last seven months of 1905 was 69,845, or little more than one-fourth of the number, 263,789, recorded in the last seven months of 1904. In the Native States the registered plague deaths totalled 128,319 against 205,983 in the previous year; in every month there was a decrease as compared with 1904, but the decline was most remarkable in the last seven months of the year. As in 1904, the maximum incidence of the disease occurred in April, and, for the fourth year in succession, the minimum was recorded in July.

As we have seen, the year 1905, apart from plague, was exceptionally unhealthy, but the deaths from plague in British territory numbered more than one-fifth of the total deaths recorded under the heading fevers, were more than twice as numerous as the exceptionally large number of deaths ascribed to cholera, and were three and a half times as numerous as the deaths from dysentery and diarrhœa. The mean plague death-rate in the British provinces was 4·17 per thousand; females suffered far more than males, the death-rates of the sexes being 3·83 and 4·52 per thousand, respectively, of the census populations of males and females. Although the numbers of deaths in Eastern Bengal and Assam and in the North-West Frontier Province were trifling, no British province, except Coorg, was altogether free from the disease, and no Native State escaped, except those in Madras, the Central Provinces, and Baluchistan. In each of the Presidency towns the number of deaths rose; the totals in 1905 were, in Calcutta, 7,372; in Madras, 22; and in Bombay, 14,171; against 4,689, 8, and 13,504, respectively, in 1904; and in Rangoon where the disease appeared for the first time in epidemic form in February, 1905, there were 2,468 deaths.

In last year's report an account was given of the epidemiology of plague in India founded upon the evidence contained in the numerous official reports on the disease, and upon special reports contributed by most of the experienced observers in this country. There is no new fact of importance from the point of view of general epidemiology to add this year, but the conclusions and speculations based upon statistical data are now being justified or modified by the precise methods of the laboratory.

We saw that an Advisory Committee representing the India Office, the Royal Society, and the Lister Institute had been established, and that a Commission to work in India under their direction at the problems of the etiology of plague, had been appointed. It is now some eighteen months since the working Commission began their labours and the Advisory Committee have recently issued reports of some of the results achieved which bid fair to overshadow in importance all recent experimental work of a similar kind.

On the departure from India of Dr. Martin in October, 1905, Major Lamb assumed direction of the working Committee which consisted of the following members:—

Major George Lamb, Indian Medical Service.
Captain W. Glen Liston, Indian Medical Service.
Dr. G. F. Petrie, Assistant Bacteriologist, Lister Institute.
Mr. S. Rowland, M.A., &c., Assistant Bacteriologist, Lister Institute.
Captain T. H. Gloster, Indian Medical Service.
Assistant Surgeon M. Kasava Pai, M.B., C.M., Madras.
Mr. V. L. Manker, L.R.C.P., L.R.C.S., D.P.H.
Hospital Assistant, Ramachandier, Mysore.
Hospital Assistant C. R. Avari, Bombay.

In order adequately to estimate the importance of the work done by the Commission it would be necessary to form a clear conception of the ideas current a year

ago regarding the causation of the spread of plague. It is, however, impossible to do this for the opinion of well qualified observers varied greatly. It may be said that it was generally accepted that in bubonic plague disinfection was of little value—with all that this implies—and that it was widely believed that the rat was in some way the important factor in the spread of the disease. How it was spread by the rat was not understood, and although the theory of transference by fleas was well known, the flea was not believed to be the principal, or even a common agent; and many of the best observers would have been found ready to agree with Dr. Klein that, while it was possible for a flea that had just sucked from a rat blood well charged with *B. pestis*, by biting, to inoculate another rat, such an occurrence was not under natural conditions likely to occur. At the Plague Research Laboratory, where Captain Liston was working, ideas were much more advanced. It had been found that the common flea on rats in India,—provisionally named *P. pallidus* until identified by the Honourable C. N. Rothschild as *P. cheopis*—was very like *P. irritans*, and that, when deprived of its natural host, it would bite other animals. Captain Liston had made the discovery that guinea-pigs could be used as "traps" for rat fleas in plague-infected houses—a discovery of which it is impossible to overestimate the importance—and he had found that some of the fleas caught in this way had in their stomachs large numbers of plague germs which so far from being destroyed by the digestive juices, appeared to be multiplying. Many of the guinea-pigs on which such fleas were found died of plague. It had been shown that healthy animals could live beside plague-sick animals, and not contract the disease, and while there was no doubt that it was possible to communicate plague by way of the alimentary canal, it had been found that rats could eat small quantities of contaminated food without suffering any ill effects. It had been ascertained also that plague germs soon die in earth taken from the floors of Bombay houses. Attempts had been made to communicate the disease by means of fleas transferred to a healthy animal after feeding on a plague-sick animal, but these attempts had not been successful, owing, no doubt, to the germs in the blood of the plague-sick animal not being sufficiently numerous to infect the fleas.

One result of these experiments was the creation in the laboratory of a staff accustomed to handle and dissect rats, which greatly facilitated the development of the excellent arrangements which, with the freely given aid of the Bombay Municipal authorities, the Commission succeeded in organising for the purposes of their enquiry.

Transfer of Plague from Rat to Rat.—The Commission found* that if, in the presence of the rat flea, a healthy rat was confined in close proximity to a plague-infected rat, but in such a way as to preclude the possibility of contact with its body and excreta, the healthy rat frequently became infected. In cases where the healthy rat became infected, the infection must have been carried by the air or by fleas. In order to exclude aerial infection, attempts were made to conduct similar experiments in the absence of fleas; but, as it was found impossible to ensure the absence of fleas, experiments were made to ascertain whether plague could be transferred by fleas taken from rats in the septicæmic stage of plague to healthy rats. In 21 out of 38 experiments, healthy rats living in flea-proof cages, contracted plague after fleas taken from rats dying or dead of septicæmic plague had been placed on them.

Effects of Structure and of Light.—A series of experiments were conducted in specially constructed godowns which had been designed by Lieutenant-Colonel Bannerman and Captain Liston. There were in all six of these godowns, and the essential differences between them were the structure of the roof and the amount of light admitted. Two of the godowns were roofed with country tiles which afford good shelter for rats; two with Mangalore tiles, which afford little shelter for rats; and two with corrugated iron, where rats could not penetrate. In one of country tile roofs and in one of the Mangalore tile roofs there was a sky light. It was found that rat fleas were more abundant in the godowns roofed with country tiles than in the godowns roofed with Mangalore tiles, and that in both sets of godowns the number of fleas was far greater in the absence of light. In the godowns roofed with corrugated iron, only a few fleas were found which may have been introduced on the guinea-pigs used in the experiments.

Experimental Epidemics.—These godowns were used for a series of experiments in which a large number of healthy guinea-pigs were kept in confinement along with

* *Vide* "Journal of Hygiene," No. 4, Vol. 6, September, 1906.

a number of others infected with plague. It was found that epidemic plague did not occur when healthy guinea-pigs lived in close contact with plague-infected guinea-pigs if the access of fleas was prevented; but, in exactly similar conditions, if fleas were present in considerable numbers, plague spread among the healthy animals.

Fleas taken from guinea-pigs dying with plague started an "epidemic" among healthy guinea-pigs living in an uninfected godown, and this "epidemic" was maintained by the addition, from time to time, of other fleas.

It was found that when an "epidemic" has occurred among a number of guinea-pigs the contagion remains in the place of their confinement, and is effective in proportion as test animals introduced into it are accessible to and found infested with fleas, and that animals in a cage suspended two feet from the floor escaped the disease, while animals in a cage suspended two inches from the ground were infected.

Conditions in Plague-infected Houses.—Among the most interesting and valuable experiments performed by the Commission were those in which guinea-pigs were introduced into plague-infected houses. The following is a summary of, and conclusions drawn from, these experiments:—

"(1) Guinea-pigs allowed to run free in plague houses in many instances attracted a large number of fleas, which fleas were mostly rat fleas. A certain percentage (29) of these animals contracted plague, and died from the disease. The position of the bubo in the great majority of these cases was cervical.

"(2) If a plague house had been previously disinfected by the ordinary means of disinfection, fleas were still caught in large numbers on guinea-pigs set free in them. Further, a considerable number (29 per cent.) of these animals died of plague. The bubo in the great majority of these cases was again in the cervical region.

"(3) Fleas transferred from plague-infected rats found dead or dying in houses, were able to transmit plague to healthy animals in flea-proof cages in the laboratory. The bubo in all cases was in the cervical region.

"(4) Fleas transferred from guinea-pigs and other animals which had been placed for a few hours in plague houses, were able to transmit the disease to fresh animals when fed on these in flea-proof cages in the laboratory. The situation of the bubo in these animals was in the great majority of cases in the cervical region.

"(5) Animals were placed in plague houses in pairs, both protected from soil and contact infection, and both equally exposed to aerial infection, but one protected from fleas by means of a fine metallic curtain, and the other not so protected. None of the protected animals contracted plague while several of the unprotected animals died of the disease. The position of the bubo in every instance was in the cervical region.

"(6) Animals were placed in plague houses in pairs, both protected from soil and contact infection, and both equally exposed to aerial infection, but one surrounded with a layer of 'tangle-foot'* and the other surrounded with a layer of sand. The following observations were made:—

(*a*) Many fleas were caught on the tangle-foot, a certain proportion of which were found on dissection to contain in their stomachs abundant bacilli microscopically identical with plague bacilli. Out of 85 human fleas dissected only one contained these bacilli, while out of 77 rat fleas 23 were found thus infected.

(*b*) The animals surrounded with tangle-foot in no instance developed plague, while several (24 per cent.) of the non-protected animals died of the disease."

The Effect of Passage on the Virulence of B. pestis.—A contribution was made to the vexed question of the effect upon the virulence of *B. pestis* produced by repeated passage through the rat. Twenty-six passages occupying 89 days were effected by subcutaneous injection, but while there was evidence of varying susceptibility to plague among the rats of Bombay, there was no evidence of alteration in the virulence of *B. pestis*. A similar series of passages were made by cutaneous inoculation; no change in the virulence of the bacillus resulted, but it was found that a large percentage of Bombay rats were immune to infection in this way. Comparison with the records of experiments made at the Plague Laboratory in 1904 showed there has been no increase in immunity of the Bombay rats in the last two years.

---

* A sticky fly-paper.

Duration of Infection in Floors.—A series of important experiments were conducted for the purpose of determining how long infection persists in floors which have been contaminated with cultures of plague bacilli. It was found that floors of cowdung retain infection for 48 hours; but floors of *chunam* do not retain it for 24 hours, infectivity being tested in both cases by cutaneous inoculation. Testing infectivity by allowing susceptible animals to run freely about on the floors, it was found that while cowdung floors retained infectivity for 12, but less than 24, hours, *chunam* floors retained it for six but less than 12 hours.

Bacilli in Blood, Urine, and Fœces of Rats.—The following is a summary of the results of the experiments made. The blood of plague-infected rats may contain an enormous number of plague bacilli, even as many as 100,000,000 per c.c. having been found before death. On the other hand, rats occasionally die from plague with little or no septicæmia. An insect sucking the blood of most rats shortly before death would imbibe a large number of bacilli.

While the blood of a rat may have as many as 100,000,000 organisms in a c.c., the urine may have none at all, or at least less than 10 per c.c. Plague bacilli were discovered in the urine in 29 per cent. of the cases. When the urine does contain plague bacilli they are always present in much fewer numbers than in the blood.

The fæces of rats dead of plague and the blood of which contained abundant bacteria, are not highly infective, and would appear to play little part in the spreading of the epizootic.

Human Plague Septicæmia.—The blood of 28 persons suffering from plague was examined. In 12 cases no bacilli were discovered, the 12 including all those (five) that ended in recovery. It was found that plague septicæmia may be irregular in type, and that it may occur at a comparatively early stage of the disease. It appears that microscopical examination of the blood is not a trustworthy method of determining the degree of septicæmia.

Chronic Plague in Rats.—Chronic plague was found to exist among rats in a village in the Punjab during the absence of acute plague. The affected animals were not emaciated, and did not appear to suffer in any way. It is of importance, because it suggests infection by food, that the bubo in each case was within the abdomen.

Varieties of Rat Fleas.—An interesting note by the Honourable C. N. Rothschild shows that in Great Britain and Northern Europe the common flea on rats (*M. decumanus*, and probably *M. rattus* also), is *Ceratophyllus fasciatus*; but in India, and probably throughout the old world the common rat flea is *P. cheopis*.

Inoculation.—The Director of the Parel Laboratory, Bombay, reports that the demands for prophylactic vaccine during 1905 were more than double those of 1904. The opinions of those who have had considerable experience in the use of this fluid, as prepared at the Parel Laboratory, are that (1) the state of health remained unimpaired after inoculation, even in cases where the inoculated were children of poor constitution; (2) the vaccine had a marked prophylactic effect; (3) immunity lasted for a period ranging from 6 to 12 months or more; and (4) no untoward results had occurred except, very rarely, an abscess at the site of inoculation due to neglect of antiseptic precautions on the part of the operator. According to some the severity of the attack among those of the inoculated who did happen to get plague was greatly diminished, the type of the disease among the inoculated being milder, and the case-mortality consequently lower, than among the non-inoculated. Before the onset of the last plague epidemic in Bombay City, the Health Officer induced a large number of the municipal labourers to submit to inoculation, and the following statistics, showing the results of this operation, are of exceptional value as the inoculated and non-inoculated were equally exposed to infection, and so under strictly comparable conditions. During the plague season the number of municipal employés inoculated was 7,182, the number remaining non-inoculated being 418. The following statement gives a tabular view of the results; if the inoculated had

——	Strength.	Attacked.	Died.	Percentage.	
				Attacked.	Died.
Inoculated	7,182	14	13	·19	·18
Non-inoculated ...	418	28	26	6·7	6·2

suffered to the same extent as the non-inoculated, they would have furnished 481 attacks, and 446 deaths, instead of 14 and 13, respectively. It will be noted that the case-mortality, in this instance, is identical (92·85 per cent.) among inoculated and non-inoculated; there can, however, be no doubt about the prophylactic value of the vaccine, and it is certain that inoculation is a most efficient measure in dealing with epidemics of plague. On the appearance of an outbreak, as we have no effectual means at present of destroying rats and their fleas, the people must vacate infected houses (*i.e.*, go away from the infected rats and their fleas), or submit to inoculation (*i.e.*, be protected against the disease), or, better still, combine the advantages of evacuation and inoculation. If evacuation is impossible, inoculation is indispensable.

The Destruction of Rats.—The relation of rat plague to human plague, and the connection that rats and rat fleas have with the spread of human plague have already been discussed. It is obvious that every infected rat destroyed means the removal of a source of infection, and, consequently, the destruction of infected rats cannot fail to have a beneficial effect on plague epidemics. In Bombay and elsewhere, leaflets on the advisability of killing rats have been distributed freely amongst the people. Various methods of killing rats have been tried, but the two which have won most favour are (1) the "wonder" rat trap, and (2) the proprietary poison known as the "common sense exterminator." *Danysz' virus* has had an extensive trial in several provinces, but the results have not been satisfactory. During the last plague season an experiment was conducted in the Punjab to test the efficacy of rat destruction as an anti-plague measure. A tract of country, about 70 or 80 square miles in area, was mapped off in the Delhi district, and in this area rat killing was carried out systematically and energetically. The experiment, however, failed to show any marked contrast between the plague incidence in the area selected for rat destruction, and in other areas of the district for two reasons, namely, (1) the whole Delhi-Gurgaon district escaped with very little plague during that particular season; and (2) in consequence of the popularity of the measure with the people a considerable amount of rat destruction was carried on in areas adjoining the experimental one. No definite conclusion could, therefore, be drawn from this particular experiment, but "the evidence so far as it goes is favourable to rat destruction as an anti-plague measure." One important point was brought out by the results of this experiment—the difficulty, apparently the impossibility, of completely freeing a place from rats. In a large village (Fattehpur Biluch), which had suffered from plague in previous years, rat destruction was carried on extensively and zealously, yet "plague broke out, apparently from endemic infection, and was accompanied by *rat* mortality"; the only discernible effect, which could possibly be attributed to the destruction of rats was that the spread of the epidemic was extremely slow, and the incidence of the disease slight in this village compared with neighbouring villages in which rat destruction had not been attempted. In other districts, and in other provinces, rat killing was carried out on a large scale; the results are encouraging, but, as the incidence of plague during the past season was light in many untreated areas in the same districts and provinces, it would be fallacious to conclude that a decrease in prevalence of plague in treated areas was entirely due to rat destruction. The question which requires to be considered, and the answer to which will settle the degree of importance to be attached to rat destruction as an anti-plague measure is "how near an approach to absolute extermination of rats in a given area is practically possible?" If absolute extermination in an infected locality is impossible, it is evident that rat destruction will not guarantee the non-recrudescence or suppression of plague in that locality; all that can be expected from the measure is diminished severity of plague epidemics.

Plague in Bengal.—Plague raged with great virulence in Bengal during 1905, and carried off 126,084 persons against 75,433 in the previous year, the ratios being 2·52 (the highest on record in this province), and 1·51 per mille, respectively. The average number of deaths of the preceding quinquennium was only 58,225. As in previous years, a larger number of females (70,833) succumbed to this disease than males (55,251). Five districts out of 32 escaped entirely from plague. The highest death-rates in districts were 14·79 per mille in Saran, 14·72 in Patna, and 8·83 in Gaya. The civil surgeon of Patna states that the incidence was very heavy amongst the Muhammadan weavers who are fatalists, and do not generally vacate their houses when infected. As regards towns, the highest rates were 65·98 per mille in Daudnagar, 43·22 in Siwan, 29·59 in Revelganj, 29·51 in Tikari, and 28·79 in

Monghyr. The largest number of cases was reported in March, and the smallest in July. Rat destruction was carried on in many places but notably in the Giridih coal fields and in Bihar.

Plague in Eastern Bengal and Assam.—During 1905 only six deaths from plague were reported in Eastern Bengal and Assam; all the cases were imported. Campaigns against rats were carried on by means of the "common-sense exterminator" in the towns of Dhubri, Sylhet, and Silchar; the reports on the use of this poison were favourable.

Plague in the United Provinces.—In 1905 the number of plague deaths registered in the United Provinces was 383,802, equal to a ratio of 8·05 per mille (the highest on record in this province), as compared with 179,082 deaths, and a ratio of 3·75 per mille in 1904. The greatest number of deaths from this cause occurred in March, and the smallest in July. The districts which suffered most during the year were Muttra with a death-rate of 62·64 per mille, Ghazipur with 22·03, Allahabad with 19·94, Agra with 19·08, Ballia with 17·14, and Muzaffarnagar with 16·30. Only one district (Almora) was entirely free from the disease, but from Naini Tal only three cases were reported. Out of 107 towns having a population of 10,000 and upwards, only eight remained free from the disease throughout the year; the towns most affected were Kiratpur (Bijnor), with a death-rate of 71·82 per mille, Dibai (Bulandshahr) with 52·94, Hapur (Meerut) with 44·39, Brindaban (Muttra) with 41·51 and Ramnagar (Benares) with 41·17.

Plague in the Punjab.—The number of deaths attributed to plague in the British districts of the Punjab during 1905 was 334,897, giving a death-rate of 16·65 per mille of population; the epidemic was of considerably less severity than that of the previous year with its 396,357 deaths, and death-rate of 19·71 per mille. (The mortality, however, in the Native States of this province was much higher than in the previous year.) In each of nine districts over 20,000 people perished from this cause; Rohtak lost 31,952, Amritsar 29,931, Gurgaon 29,172, and Lahore 28,787. In ten districts the death-rates recorded were over 20 per mille of the population, the highest rates being 52·63 in Rohtak, 40·88 in Gurgaon, 34·21 in Ludhiana, 33·99 in Amritsar, and 29·69 in Lahore. The districts of Simla and Muzaffargarh remained entirely free from the disease during the year. The mean mortality in rural areas fell from 20·34 in 1904 to 17·22 in 1905, and that in towns from 14·09 to 11·63. None of the towns suffered very severely during the year, 8·39 in Jullundur, and 6·91 in Amritsar being among the highest rates. The month of greatest prevalence was April, May coming next; fewest cases occurred in September.

Plague in the North-West Frontier Province.—There were only three cases of plague in the North-West Frontier Province during 1905, all three having been imported from the Punjab. In each case all necessary precautions were taken to prevent the spread of the disease, with successful results. It is noteworthy that although cases of plague have been frequently imported into this province the disease has never, at least up to the close of 1905, gained a footing on the west side of the Indus.

Plague in the Central Provinces and Berar.—In 1905 there were 5,345 deaths from plague in the Central Provinces as compared with 32,820 in 1904. In two (Damoh and Narsinghpur) of the 19 districts, no death from this cause was reported, and in each of four others the number of deaths recorded was less than six. The districts which suffered most were Burhanpur (541 deaths) with a death-rate of 5·82 per mille, Jubbulpore (1,535 deaths) with a rate of 2·96, Chhindwara (913 deaths) with a rate of 2·24, and Balaghat (602 deaths) with a rate of 1·84.

In Berar the number of deaths from plague reported during the year was 7,361 against 10,046 in 1904. The highest death-rates in the districts were 5·92 in Buldana (3,632 deaths) and 4·51 in Akola (3,407 deaths); only one death was reported in the district of Yeotmal during the year.

The month of maximum plague fatality in these provinces taken together was October, March coming next; that of minimum fatality was July, in which only one death from this cause occurred; there was an exceptionally heavy incidence of plague in Akola in October. The proportion of males that succumbed to the disease was slightly greater than that of females. Various methods of destroying rats

were experimented with in these provinces during the year: the "common sense exterminator" was tried in a few places with satisfactory results; Danysz rat virus was also tested, but proved a failure.

Plague in Madras.—The number of deaths from plague reported in the Madras Presidency during 1905 was 5,788 as compared with 20,125 in the previous year. Most cases were recorded in January and fewest in June. Out of a total of 23 districts, no death from this cause was registered in seven, viz., Ganjam, Godavari, Guntur, Kistna, Nellore, Tinnevelly and Trichinopoly, and in six others only a few imported cases occurred. In the remaining ten districts the highest death-rates were 3·6 in Bellary and 1·9 in the Nilgiris. In Bellary and South Canara the disease was present throughout the year. As regards towns, plague was indigenous in Bellary, Adoni, Madras, Ootacamund, Coonoor, Tiruppatur and Mangalore. The destruction of rats was vigorously undertaken, the method which has largely found favour in many quarters being poisoning by the "common sense exterminator."

Plague in Bombay.—Plague was much less prevalent in the Bombay Presidency during 1905 than in the previous year, 71,363 deaths (37,790 males and 33,573 females) having been recorded against 223,957 in 1904. The death-rate fell from 12·12 per mille in 1904 to 3·86 per mille in 1905, the mortality during the year under review being thus less than one-third of that during the preceding year. Only in the two years 1897 and 1900, since the appearance of plague in India in 1896, was the number of deaths registered less than in 1905. This abatement of plague was shared by all the districts in the Presidency, except Ratnagiri and three districts (Larkhana, Sukkur, and Upper Sind Frontier) in Sind; in Bombay City, also, there was a slight increase. In Sind, Thar and Parkar was entirely free from plague and all the other districts, except Karachi, were only very slightly affected. The highest ratios recorded in districts were 11·68 in Satara, 6·53 in Karachi, 5·59 in Dharwar, and 5·40 in Belgaum; the rate in Bombay was 18·63. Out of a total of 63 towns, 52 (*i.e.*, 82·54 per cent.) were affected by plague, the highest rates being 38·41 per mille in Yeola (636 deaths), 24·86 in Karachi (2,807 deaths), 22·92 in Hubli (1,380 deaths) and 21·15 in Borsad (275 deaths). In November of 1904, a fall in the recorded plague mortality was noted, and from this date the mortality continued to fall steadily, with the exception of a slight rise in March, during the first half of 1905—reaching a minimum in June. From June to September the numbers of deaths gradually increased but fell steadily again from September till the end of the year; so that in December of 1905 only 2,459 deaths from plague were registered as compared with 17,105 in December of 1904, and 24,451 in December of 1903. Most cases were reported in January and fewest in June. Although the incidence of plague was so much lighter during the year, there appeared to be no diminution of the virulence of the disease; the average case-mortality was 75 per cent.

Plague in Burma.—Up to the end of 1904 the occurrence of plague in Burma was limited to imported cases, of which two terminated fatally in 1899, three in 1900, three in 1901, nine in 1903, and three in 1904. During 1905 there were 4,132 cases, and 3,692 deaths. The case-mortality is thus no less than 89 per cent., from which it may be suspected that many non-fatal cases were not reported, and helped to scatter about infective material. The first case that was certainly indigenous occurred in Rangoon in the third week of February, and many more cases were reported during the month. The outbreak originated in the Mussalman quarter of the town, where there were large grain stores; and, as all cases were not reported, and surveillance of contacts was impossible, infection spread rapidly within and beyond Rangoon. From the time of its recognition in February, plague has been present in this town throughout the year. In Lower Burma the mortality rose rapidly during March and April, continued high until July, and then steadily declined during the remaining months of the year: to a total of 3,045 deaths during the year, Rangoon alone contributed 2,468. In Upper Burma the heaviest incidence occurred in November and December, the total number of deaths recorded being 647—all of which, with the exception of one in April, were registered during the last six months of the year. The provincial sanitary commissioner states that meteorological conditions are apparently less in favour of the spread of the disease in Lower than in Upper Burma. The districts chiefly affected were Rangoon (9·79 per mille), Bassein (·43) and Toungoo (·38) in Lower Burma; and Meiktila (1·93) with 482 deaths, and Yamethin (·66), with 160 deaths in Upper Burma. No deaths

from this cause were reported from the Arakan division or the districts of Tavoy and Mergui in Lower Burma; or from the Minbu division or districts of Shwebo, Lower Chindwin, Kyaukse, and Myingyan in Upper Burma.

Plague in Coorg.—No death from plague was reported in Coorg until 1903, in which year 45 deaths were recorded. In 1904 the number of deaths from this disease was 25: in 1905, however, no death from this cause was registered.

Plague in Ajmer-Merwara.—The number of deaths from plague recorded in Ajmer-Merwara during 1905 was 2,480 against 158 in 1904. Most cases occurred in March, April, and May, when 665, 1,272, and 315 deaths, respectively, were registered, while in June no death from this cause was reported.

Fevers.—The total number of deaths recorded in British territory under the heading "fevers" during 1905 was 4,417,655, yielding a ratio of 19·57 per mille of population, as compared with a total of 4,093,981 and a ratio of 18·09 per mille in 1904. The death-rate returned under this heading in 1905 was higher than in any year since 1897, with the exception of 1900 and 1903. The year 1905 was in all respects more unhealthy than 1904, and it was to be expected that a large portion of the increased mortality during the year would be accounted for under this comprehensive heading. The largest number of deaths from fevers were, as usual, recorded in October, November, December, and January; there was also a slight, but very perceptible increase in the registered numbers of deaths under this heading in May and June; the lowest numbers were recorded in July and August.

In Bengal the death-rate for fevers during 1905 was 24·34 per mille of population against 20·49 per mille in 1904. As in the previous year, the highest number of deaths was recorded in November, and the lowest in July. The highest death-rates during the year were recorded in the districts of Shahabad, Nadia, and Gaya. The Provincial Sanitary Commissioner states that the heavy mortality in Shababad and Gya was due to extensive floods which occurred in August, and lasted about six weeks; the number of deaths recorded under this heading from September to December was as large as that registered during the other eight months of the year. The mortality from fevers was higher than in the previous year both in urban and rural areas, but the increase in rural areas was especially marked.

In Eastern Bengal and Assam the death-rate for fevers during 1905 was 23·68 per mille as compared with 23·60 in the previous year, and an average of 23·35 during the previous decennium. The largest number of deaths was registered in January and the smallest in March. Dinajpur district as usual heads the list with a ratio of 36·15 per mille, Rajshahi coming next with 33·95 and Pabna next with 33·91. Among towns, Barpeta reported a mortality of 33·38 per mille as compared with a quinquennial rate of only 13 per mille; the Provincial Sanitary Commissioner suspects that in this town (see the remarks under small-pox) some cases registered under fevers should really have been classed under small-pox. The recorded number of deaths from *kala azar* was 3,030 as compared with 3,748 in 1904, 5,033 in 1903, and 6,319 in 1902, the districts reporting the largest numbers being Darrang (1,106 deaths), Sylhet (955 deaths), Kamrup (499 deaths) and Nowgong (379 deaths).

In the United Provinces the death-rate for fevers during 1905 was 26·92 per mille, being 3·0 per mille higher than in the previous year, and 2·29 per mille higher than the mean of the antecedent quinquennium. The number of deaths registered under this heading during the year was 1,284,164 against 1,141,029 in 1904. The rate as well as the actual number of deaths in these provinces were considerably higher than in any other province of India. The largest number of deaths was recorded in December and the smallest in August. Saharanpur and Ghazipur were the districts with the heaviest mortality; and, among towns, Brindaban (Muttra) again showed the highest death-rate. In most provinces the rural death-rate was much larger than, often twice as large as, the urban, but in the United Provinces the two rates were practically the same, viz., 26·92 per mille in rural and 26·98 per mille in urban areas.

In the Punjab the total number of deaths recorded during 1905 as due to fevers was 370,047, giving a ratio of 18·04 per mille, which is ·42 per mille lower than the recorded rate in 1904, and 6·65 per mille less than the mean of the preceding quinquennium. December was the month with the largest number of deaths and September the month with the smallest. The Provincial Sanitary Commissioner states that the decrease in the death-rate for fevers was anticipated

as the rainfall during July and August was very scanty. The highest mortality was recorded in the districts of Delhi (24·74), Attock, Mianwali and Muzaffargarh. The Civil Surgeon of Delhi attributed the high mortality in that district to plague deaths in many cases having been classified under fevers. In the other three districts mentioned, deaths from "respiratory diseases and other causes" are supposed to have swelled the number of deaths recorded from fevers. The mortality reported in March was unusually high, especially in some of the plague-infected districts, and the Provincial Sanitary Commissioner thinks it probable that a certain number of deaths really due to plague were registered under fevers. The rural death-rate was only slightly higher than the urban.

In the North-West Frontier Province the death-rate for fevers (20·69) was lower than in the previous year, but higher than the mean of the preceding quinquennium. In the Peshawar District, as usual, the highest rate was recorded. The highest mortality occurred in December; and regarding this the Provincial Sanitary Commissioner states that the heavy mortality in December was probably due to a great variety of diseases, and by no means entirely due to malarial fevers.

In the Central Provinces and Berar the death-rate for fevers rose from 13·54 in 1904 to 17·43 in 1905, every district without exception contributing to this increase. The highest mortality was recorded in September, October, and November and the lowest in January, March, and July. It is thought probable that deaths from plague and influenza were in many cases recorded under fevers.

In the Madras Presidency the death-rate recorded for fevers was 7·2 per mille, which is ·8 per mille less than in 1904, and 1·0 per mille less than the mean of the preceding quinquennium. The death-rate during the year in this Presidency was, as usual, much lower than that recorded in any other of the large provinces. The districts of Vizagapatam and Ganjam, as in the previous year, returned the highest rates, viz., 15·8 and 15·0, respectively. The reported numbers of deaths were larger in November, December, and January, and least in February and March. The Provincial Sanitary Commissioner ascribes the decrease in the recorded fever mortality to people purposely reporting deaths from fevers under other headings in order to escape the enquiries that would be instituted if plague was suspected to be the cause of death.

In the Bombay Presidency the death-rate for fevers was 13·28, which is ·32 per mille less than in the previous year, and 4·12 less than the mean of the antecedent quinquennium. The number of deaths recorded during each of the six months, May to October, did not exceed 20,000, while the number recorded during each of the other months of the year was never below 22,000; the largest number was registered in January. The districts with the highest mortality were Ahmedabad (28·38), Thar and Parkar (22·47) and Broach (20·65); the lowest death-rate was 3·41, recorded in the City of Bombay.

In both Lower and Upper Burma the recorded death-rates under fevers were slightly less than the corresponding figures of the previous year or means of the preceding quinquennium; during 1905, the rate in the former was 8·97 and in the latter 6·76. In Upper Burma the rural death-rate was not much higher than the urban.

Both in Ajmer-Merwara and Coorg the recorded death-rates for fevers were lower in 1905 than in the previous year.

Sale of Quinine.—In Bengal there was a reduction in the number of packets of quinine distributed during 1905, only 35,472 parcels (each containing 102 seven-grain packets) having been sold as compared with 38,041 during 1904. Most of the packets were bought by the villagers during the four months August to November. Sanction has been accorded to the opening of new centres for the distribution of quinine through the agency of village schoolmasters in areas which are distant from dispensaries and post offices.

In Eastern Bengal and Assam the sale of quinine decreased slightly during 1905 as compared with the previous year. In October a scheme was brought into force in Assam by which (1) a depot at the office of the Civil Surgeon has been opened in each district; (2) the number of distributing agents has been increased by including, besides postmasters, the village schoolmaster, the *mauzadar* and the *gaonbura*; and (3) the price of the drug has been reduced so that the retail agents might make a respectable profit.

In the United Provinces the total number of packets of quinine sold during the year was 643,668 against 586,441 in 1904, an increase of 57,227. The post office

was a much more efficient agency than vaccinators and landlords for the sale of the drug. At the end of the year under report, an attempt was made to increase the sale of quinine by means of district boards and aided schoolmasters.

In the Punjab quinine was, as usual, gratuitously distributed in a large number of districts, but, beyond the statement that in the district of Delhi quinine was sold in all the villages, no information regarding the sale of the drug is contained in the Provincial Sanitary Commissioner's Report.

In the Central Provinces and Berar the sale of quinine showed an increase during the year, 4,887 packets having been sold as compared with 4,781 in 1904. As usual, postmasters sold the greatest number of packets; village schoolmasters sold 125 packets, patwaris 53, and stamp vendors 37.

In Burma the sale of quinine has met with a fair amount of success, more than twice as many packets having been sold by vaccinators as by postmasters. The Burman apparently believes in the efficacy of quinine, but objects to its taste; consequently, many officers have urged that quinine should be available in the form of tabloids.

Details are wanting regarding quinine sales in the North-West Frontier Province, Madras, and Bombay.

Dysentery and Diarrhœa.—The number of deaths recorded in British territory under the heading of dysentery and diarrhœa rose from 240,655 in 1904 to 264,124 in 1905, and the death-rate per mille of population from 1·06 to 1·17. As shown in the statement of the first paragraph of this section, the death-rate recorded under this heading during 1905 is, except for 1·21 recorded in 1903, the highest in the quinquennial period 1901-5. A higher mortality than in 1904 was reported in all the provinces except the North-West Frontier Province and the Bombay Presidency; but the increased mortality during the year under review was due chiefly to a severer prevalence of the diseases in the Central Provinces, Eastern Bengal and Assam, and the Madras Presidency. In India as a whole the largest numbers of deaths from these diseases were recorded in August and September, and the smallest in February and March; but there are frequently wide differences in the seasonal incidence in even adjacent provinces.

In Bengal the death-rate from dysentery and diarrhœa in 1905 was ·90 per mille of the population as compared with ·82 in 1904 and ·99, the average of the quinquennial period ending 1904. The districts in which the highest death-rates were recorded were, as usual, Howrah, Patna, Puri, Calcutta, Cuttack, Darjeeling and Hooghly. The urban morality was more than four times as large as the rural. The Provincial Sanitary Commissioner reports, as the results of a special enquiry, that in Orissa infantile diarrhœa is extraordinarily common, and is the chief cause of the high death-rate, the number of deaths of children under five years being nearly equal to that of persons above that age; that many more deaths are due to acute diarrhœa than to dysentery; and that the bad water-supply and the ignorance of the people are the cause of the prevalence of these diseases; that in Howrah and Hooghly the type of diarrhœa that prevails is the terminal diarrhœa of chronic malaria and *kala-azar*, infantile diarrhœa being comparatively uncommon; that in Patna, where the *chaukidars*—the reporting agents—are less intelligent than in other parts of Bengal, 61 per cent. of the deaths reported as due to dysentery and diarrhœa were found, after investigation, to be from other causes, cholera being the most important source of error. In Eastern Bengal and Assam the mortality from dysentery and diarrhœa during 1905 was considerably higher than that of the previous year, and also higher than the average of the preceding quinquennium or decennium. The heaviest mortality prevailed in the tea districts of the Assam and Surma Valleys; Lakhimpur reported a district ratio of 6·8 per mille, Sibsagar 4·6, Darrang 3·1, Cachar 3·6 and Sylhet 2·0. The only district in Eastern Bengal which reported a comparatively high rate was Dacca with 1·45 per mille. In the United Provinces the recorded mortality from dysentery and diarrhœa was higher than in the previous year, but lower than the average of the preceding quinquennium. The greatest number of deaths from this cause took place in June and the smallest in March. As in previous years the mortality was greatest in the districts of Garhwal (11·39 per mille), Almora (4·20) and Ballia (3·07); the rates in these three districts in 1904 were 8·01, 3·59, and 2·81 per mille, respectively. The urban death-rate was more than five times as high as the rural. The recorded mortality from dysentery and diarrhœa in the

Punjab during 1905 was also greater than that of the previous year, but considerably less than the average of the quinquennium 1900-04. The highest rates were recorded in the districts of Simla (2·25, Rawalpindi (1·76), Jhang (1·68), Ambala (1·34), and Kangra (1·02). Both in 1904 and in 1905 the death-rate in towns was about four times that in villages. In the North-West Frontier Province 562 deaths against 610 in the previous year were attributed to dysentery and diarrhœa; the death-rate (·28) during the year was the same as the mean of the preceding five years. Dera Ismail Khan was the district most affected. There was a large increase in the mortality from dysentery and diarrhœa in the Central Provinces and Berar during 1905, the number of deaths from these diseases being 35,879 against 26,742 in 1904; the Berar districts alone accounted for 21,276 out of the total of 35,879 deaths. The death-rate for these diseases in the Central Provinces and Berar combined was 3·02 per mille—the highest among all the provinces during the year. The incidence was especially heavy during August, September and October and, in the opinion of the Provincial Sanitary Commissioner, was probably due to a late but heavy rainfall. The highest death-rates in the districts were 10·20 per mille in Akola, 8·76 in Buldana, and 7·37 in Amraoti—all in Berar; the highest district rates in the Central Provinces were 4·91 in Wardha and 3·23 in Jubbulpore. There were only two districts (Balaghat and Bhandara) which furnished lower rates than in the previous year. No cholera was reported during the year from the Berar districts, but the Provincial Sanitary Commissioner does not think that any deaths really due to cholera were recorded under dysentery and diarrhœa. The death-rate in municipalities was 3·77 per mille as compared with 2·93 in rural areas. In Madras the death-rate from dysentery and diarrhœa was 1·4 per mille in 1905 against 1·3 in 1904 and an average of 1·2 in the quinquennium 1900-4. The highest district-rates were 11·2 in Madras and 4·4 in the Nilgiris. The Provincial Sanitary Commissioner states that the prevalence of these diseases in Madras was due to "the influx of pauper ryots and coolies into the city from the adjoining districts in quest of labour," to the consumption of inferior grains and other articles of food by the poorer classes, and to the insufficient and polluted water-supply. Compared with the rural death-rate (1·1), the urban (4·0), was slightly higher than usual during the year. In Bombay the death-rate per mille and the total number of deaths from dysentery and diarrhœa showed a considerable reduction during 1905 in comparison with the figures of the previous year, and the averages of the previous quinquennium. The death-rate was 3·00 per mille as compared with 3·33 in 1904 and a mean of 4·87 during the quinquennium 1900-4. It is worthy of note that in 1905, the death-rate from dysentery and diarrhœa in Bombay was not the highest provincial rate, but followed that recorded in the Central Provinces and Berar. These diseases were most prevalent during August and September, most deaths as usual having been registered in August; they were least prevalent in November and December. The highest ratios were recorded in the districts of Khandesh (9·53), Poona (6·03), Ahmednagar (5·73), Sholapur (5·03) and Nasik (4·80). The death-rate in rural areas was 2·91 per mille, while that in towns was 3·61; the relatively high rural death-rates in this Presidency and in the Central Provinces and Berar are noteworthy. In Lower Burma the recorded death-rate from dysentery and diarrhœa in 1905 was 1·43 per mille as compared with 1·27 in 1904 and a mean of 1·48 in the preceding quinquennium; in Upper Burma it was ·44 per mille as compared with ·31 in 1904 and a mean of ·33 in the preceding quinquennium. In Lower Burma the urban rate was more than three times as high as the rural, but in Upper Burma the urban was ·60 per mille while the rural was ·43. The relatively high death-rate in the towns of Lower Burma is attributed to the general use in these towns of cess-pits for the disposal of night-soil and to temporary floodings of these towns, *e.g.*, Thayetmyo, during the year under review. In Ajmer-Merwara, 424 deaths from dysentery and diarrhœa were registered in 1905; in Coorg 96 deaths.

General History of Vaccination.

(For Statistical Tables, *see* page 149).

Vaccination in India.—During the year 1905-06, the number of persons vaccinated by all agencies in British India reached a total of 9,277,896, which indicates a steady continuance of the increase observed in the work of the vaccination department during the past three years—1902-03 (8,431,564 operations), 1903-04 (8,457,298) and 1904-05 (8,944,749). With the exception of the Madras and Bombay presidencies every province shared in the increase, the rise in the figure in Bengal (222,999) being specially notable; Eastern Bengal and Assam and Burma followed with increases of 76,947 and 75,924 operations, respectively. The decreases in the Madras Presidency (18,279) and in the Bombay Presidency (12,669) were comparatively insignificant and will be explained in the paragraphs relating to these provinces; in the former, however, the number of successful cases in 1905-06 (1,296,312) was greater than in the preceding year (1,242,717). Taking British India as a whole, the primary cases numbered 8,586,770 as compared with 8,351,257 in 1904-05, and the percentage of success in the two years was 97·20 and 96·04, respectively. Revaccinations increased from 593,492 in 1904-05 to 691,126 in 1905-06, but the percentages of success fell slightly from 74·71 to 74·20. In the provinces the percentage of success varied in primary cases between 99·19 in the Punjab and 90·80 in Burma, and in revaccinations between 84·78 in the United Provinces and 53·33 in Burma. The mean number of vaccinations performed by each vaccinator was 1,480 as compared with 1,487 in the previous year, the figures in the provinces ranging from 3,162 in the North-West-Frontier Province and 996 in Ajmer-Merwara. Vaccination at dispensaries continued to show an increase, there having been 207,421 operations compared with 203,705 in 1904-05, Bengal (122,105) contributing by far the largest number to the total, followed by the Central Provinces and Berar (28,790), Eastern Bengal and Assam (27,735) and Burma (17,507). The comparatively insignificant number of operations at dispensaries in the United Provinces (655) is explained by the fact that no special vaccinators are attached to those institutions, operations being performed by medical subordinates.

The mean proportion of the population successfully vaccinated, which had been 33·32 per mille in 1903-04, and 34·79 per mille in 1904-05, rose to 36·39 per mille in 1905-06. As in the preceding year the ratio was highest in Coorg (55·45) and lowest in Bombay (27·35).

On an estimated birth-rate of 40 per thousand of the census population, 43·83 per cent. of the infants were protected compared with 42·46 per cent. during the preceding year. The percentage in the several provinces varied greatly, from 76·75 in the Central Provinces and Berar and 62·54 in the Punjab to 21·27 in Burma and 11·68 in Coorg.

The total cost of the department which had been £80,245 in 1904-05, increased to £85,509 in 1905-06, and the mean cost of each successful case rose to $2\frac{5}{12}$d. The cost of each case in the provinces ranged between $8\frac{1}{4}$d. in Bombay and about $\frac{11}{12}$d. in Eastern Bengal and Assam.

Vaccine lymph.—In the paragraphs relating to individual provinces, reference is made to the vaccine material used in each, and here it is necessary to notice only the more important facts connected with the supply of vaccine.

The Shillong vaccine depôt for the supply of material to Eastern Bengal and Assam is now independent of vaccine from outside sources and can maintain its own supplies with certainty. The Patwa Dangar lymph depôt at Naini Tal is now well equipped and its utility to the United Provinces has largely increased, while the work of the depôt at Belgaum for the Bombay Presidency has been successfully launched. The proposal to establish lymph depôts in the North-West Frontier Province has been abandoned in view of the satisfactory and economical arrangements in force for obtaining vaccine from the Punjab depôt. Useful experimental work in the preparation of vaccine was done by Major Entrican, I.M.S., at the Meiktila depôt which supplies all the lymph for Burma, except Rangoon where there is a local depôt. Major Entrican devised two machines for filling lanoline vaccine in tubes and glycerinized and quinated lymph in capillary tubes, respectively. The apparatus does efficiently, in a few minutes, work which formerly occupied several hours.

Bengal.—The figures of the vaccination operations in Bengal during the year 1905-06 exclude those relating to the districts transferred to the new province of Eastern Bengal and Assam, and to admit of comparison, the figures of the year 1904-05 used below also exclude those relating to the transferred districts. The Sambalpur district was added to Bengal during the year under report, but as the vaccination figures of the district are not available they have not been included in the provincial figures.

The total number of operations performed in the remodelled province during the year 1905-06 was 2,041,230 against 1,818,231 during 1904-05. Of these totals, 1,904,625 and 1,759,124 were primary cases, and 136,605 and 59,107 revaccinations, respectively, in each of those years: the net increase was, therefore, 145,501 primary cases and 77,498 revaccinations, which is very satisfactory. The recovery in the number of revaccinations is largely due to the special efforts made by the Corporation of Calcutta to combat the severe outbreak of small-pox during the year, there having been an increase of over 50,000 revaccinations in Calcutta. Of the 33 districts of the province, 23 show an increase and only 10 a decrease. The most noticeable increases occurred in the districts of Saran (24,254), Midnapore (17,016), Jessore (12,643), the Tributary States of Orissa (12,142), Shahabad (11,631), and Nadia (11,273), while the decrease was most marked in the districts of Balasore (13,273), Sonthal Parganas (12,465), Birbhum (6,310) and Purnea (5,782). The increased work is attributed to various causes, among them more careful supervision; more energetic working; less prevalence of plague; the greater prevalence of small-pox, and in some places the introduction of the system of rewards to vaccinators. The decrease in Balasore is said to be due to the inefficiency of the staff, some of whom have been dismissed, and in the Sonthal Parganas and Purnea to the prevalence of sickness.

Generally, it is hoped that much improvement will be effected in the department in consequence of the introduction of the scheme recently sanctioned for the education of vaccinators, and the general substitution of prepared lymph for arm-to-arm vaccination.

The ratio of success in primary operations rose from 98·80 per cent. in 1904-05 to 99·13 per cent. in 1905-06, and in revaccinations from 61·63 to 66·29 per cent.

Vaccination was carried on with calf lymph (151,080 primary operations) lanoline lymph (400,847) and from arm-to-arm (1,352,698), the figures showing an increased use of calf and preserved lymph, and a smaller number of arm-to-arm cases. The percentages of success by each method was calf lymph 98·92 as compared with 99·30 in the previous year, lanoline lymph 96·57 as compared with 95·81, and arm-to-arm 99·21 as compared with 98·95. The ratios of success in revaccination by each method in 1905-06 were 58·81, 53·98 and 78·02 per cent., respectively.

At an estimated birth-rate of 40 per mille of the population, 39·18 per cent. of the infant population were successfully vaccinated, compared with 34·41 per cent. in 1904-05 and 29·36 per cent. in 1903-04, which shows that infant vaccination is making progress. In municipalities the rate of protection of infants rose to 85·82 per cent., from 65·08 per cent. in the year preceding. There was a satisfactory improvement in Calcutta where nearly half the available infant population were protected, compared with about one-fourth only of the number available in the previous year.

As in the report for 1904-05, there is again no information as to the quantity and quality of the lymph issued from the Darjeeling and Calcutta depôts during the year under report, nor is there any reference to the working of the system introduced last year of issuing lymph direct to the operators instead of through superior officers. The Darjeeling depôt as usual supplied lymph to the Nepal Darbar and the Sikkim State—380 and 860 grains respectively—the results from which were reported to have been satisfactory.

The cost of the department was £10,520 against £9,056 in 1904-05—excluding the figures for Calcutta in both years which were not received—and the cost of each successful case, $1\frac{1}{4}$d. as compared with $1\frac{1}{12}$d. in each of the two preceding years.

Eastern Bengal and Assam.—The work of the vaccination department in the new province, an account of which appears for the first time in this report, for the year 1905-06 is compared with that done in 1904-05 in Assam and the Bengal districts transferred to the new province. The total number of vaccination operations, which aggregated 1,352,079 in 1904-05, rose to 1,429,026 in 1905-06. The

distribution of the total was 1,313,998 primary cases in 1904-05 and 1,385,538 in 1905-06, showing an increase of 71,540 cases, and in revaccinations 38,081 in 1904-05 and 43,488 in 1905-06, or an increase of 5,407. The percentages of success also improved from 97·09 to 98·28 in primary cases, and from 56·95 to 71·71 in re-vaccinations. The most marked increase in the number of operations occurred in the Chittagong district (53,000), and the Faridpur (18,000) and Noakhali (11,000) districts also showed large increases. In Chittagong the increase was due to special efforts made by the vaccinating staff owing to an outbreak of small-pox, the result being the highest figures on record for the district. In Faridpur opposition was overcome with very satisfactory results by calling on village headmen to show cause why vaccination should not be made compulsory. On the other hand in the Dacca district there was a fall of 21,000 operations as compared with the preceding year, which has been explained by the special activity in vaccination work in 1904-05 owing to an outbreak of small-pox, and the fact that the number of operations in that year exceeded the average. For the decreased work in other districts various reasons have been adduced. On tea gardens 15,143 primary operations were performed, of which 94 per cent. were successful.

On an estimated birth-rate of 40 per thousand of population 33·62 per cent. of the infant population were protected against 29·67 per cent. in 1904-05. Of the available number of children in towns 70·9 per cent. were successfully vaccinated.

Vaccination was carried out during the year with humanized vaccine, with manufactured vaccine (glycerine or lanoline) and with calf vaccine. The use of human lymph is to be discontinued as larger supplies of manufactured vaccine become available, and in any case it is not to be used in areas where vaccination is compulsory. The Shillong vaccine depôt is now independent of vaccine from outside sources and can maintain its own supplies, the quality of which is uniform and good, with certainty.

The department cost £5,120 in 1904-05 and this increased to £5,340 in 1905-06. In both years, however, each successful case cost $\frac{1}{1\frac{1}{2}}$d.

United Provinces.—The total number of vaccination operations in the United Provinces in 1905-06 was 1,695,416, an increase of 23,656 operations compared with the results of the preceding year. The number of successful primary operations was 1,544,152 in 1905-06 against 1,517,491 in 1904-05, or an increase of 26,661, but the number of successful revaccinations fell from 77,209 in the preceding year to 76,260 in the year under report. The percentage of success in primary cases was 97·93 in 1905-06, or a little higher than the rate of 97·62 in 1904-05; re-vaccinations were, however, less successful, 84·78 per cent. compared with 86·51 per cent. In 34, as compared with 31 in the previous year, of the 49 districts in the province, there was an increase in the number of successful primary operations. The districts showing the largest increases were Allahabad (4,126), Aligarh (4,049), Gonda (3,905) and Agra (3,427). Among the districts showing a falling off in the number of successful primary operations are Ballia (5,827), Sultanpur (5,607), Banda (3,848), Rae Bareli (2,223) and Benares (2,180). For the decrease in Ballia the provincial Sanitary Commissioner accepts the explanation that, apart from the effects of plague and cholera, the amount of work done in previous years has reduced the number of the susceptible population; elsewhere, the prevalence of cholera, the deputation of experienced vaccinators to the *kumbh mela* at Allahabad, and, in places, slack work on the part of vaccinators, account for the fall.

On an estimated birth-rate of 40 per mille, the number of infants successfully vaccinated represent 49·57 per cent. of those available, which is less than the percentage of 52·11 protected in 1904-05. In municipalities, infants were protected at the rate of 102·13 per cent., on the figures of birth *minus* deaths neglecting any outside addition to the number thus available, showing a recovery from the rate of 89·6 in 1904-05 to which it had fallen from 98·2 in 1903-04.

Bovine lymph depôts were maintained at Lucknow and Patwa Dangar (Naini Tal). The latter is now well equipped and its utility to the province has largely increased. Considerable difficulty was experienced in getting a good and regular supply of calves at a reasonable price. Of the 96 calves vaccinated, 88—78 cow and 10 buffalo—were vaccinated successfully. The average quantity of crude lymph yielded by a cow calf was 196 grains, and that by a buffalo calf 249 grains. Lanoline lymph was prepared only when requisitioned, glycerine lymph having been substituted for stock purposes and found to give better results. During the year

74,800 tubes and 24½ drams in bulk of glycerine lymph and 30 drams of lanoline lymph were issued. Lymph was regularly supplied from the depôt to all districts in the plains. The working of the institution is regarded as very satisfactory.

The cost of the department amounted to £10,216 or somewhat more than the cost of £9,909 in the preceding year, but the cost of each successful case 1½d. was the same in both years.

Punjab.—The working of the vaccination department in the province continued to show satisfactory improvement during the year 1905-06. The total number of operations performed by all agencies amounted to 748,739, showing an increase of 28,968 cases, equivalent to an increase of four per cent. on the figures of 1904-05, and of about six per cent. on the average of the previous quinquennium. This result is no doubt due to the close supervision exercised by the Sanitary Commissioner during the vaccine season over the work of the vaccinators and the inspections performed by the Superintendents. In primary work there was an increase of 56,291 cases compared with the number in the preceding year, but revaccinations showed a fall of 27,323, leaving a net increase of 28,968 operations during the year under report. The fall in the number of revaccinations, however, is explained by the system under which one-eighth part of a district is to be revaccinated every year, which was introduced during the preceding working season only, and time must elapse before its effects are apparent. At the same time it is necessary to allow for the fact that the people are prejudiced against revaccination, which in certain districts is much less popular than the primary operation. The revaccination of girls is unpopular in all districts. The percentage of success in primary cases was 99·19 in 1905-06, and 99·17 in 1904-05; in re-vaccinations the percentage rose to 83·38, from 81·04 in the preceding year.

On an estimated birth-rate of 40 per mille, 62·54 per cent. of the infants were protected, while in 1904-05 and 1903-04 the rates were 56·25 and 58·23 per cent., respectively. In municipalities 85 per cent. of the available children in the towns where the Vaccination Act is in force and 66 per cent. in those where vaccination is not compulsory, were successfully vaccinated; the corresponding percentages in 1904-05 were 73 and 60, respectively.

The chloroformed glycerine lymph manufactured at the Central Vaccine Institute, Lahore, proved most satisfactory. Of the 100,768 primary vaccinations performed with it during the year, there was a case success of 99·94 per cent. and an insertion success of 99 per cent., the corresponding figures in 1904-05 having been 33,210 primary cases, and case and insertion successes of 98·72 and 94·90 per cent., respectively.

The cost of the department was £6,513 or £125 more than in 1904-05, excluding the accounts of 1904-05 relating to the Kangra district which were lost in the earthquake of April, 1905. The increase is chiefly due to the employment of additional establishment for the Lyallpur district. The cost of each successful case was 2¼d. or 1½d. less than in 1904-05.

The vaccination work in the larger Native States also improved generally. In the Patiala State the number of primary operations rose from 48,490 in the preceding year to 54,086 in 1905-06, and the number of revaccinations from 30,992 to 31,034. In the other large States the work done was, Bahawalpur 18,804 primary cases compared with 20,065, nearly all primary cases, in 1904-05. In Kapurthala the recorded results were (the figures in brackets are those for the preceding year) 5,578 (4,827) cases, Nabha 1,074, Jind 6,978 (6,697) and Faridkot 5,185 (5,488), all primary operations. The revaccination work was, however, most insufficient, the total number of cases amounting to 386 only. The percentage of success in primary cases ranged between 98·09 in Faridkot and 89·77 in Nabha.

North-West Frontier Province.—The vaccination operations in the Frontier Province during the year 1905-06 numbered 100,866 compared with 77,042 in 1904-05, or an increase of 23,824. The primary cases numbered 87,771, against 74,267 in the previous year, and revaccinations 13,095 against 2,775. The percentage of success in the former was 98·56 and in the latter 84·45, compared with 98·96 and 75·39, respectively, in 1904-05. There was a marked increase in the number of operations in all districts, the political agencies and cantonments, and also in the work done by the dispensary staff, the last-mentioned performing no less than 2,845 operations against 104 only last year. The greatest rise occurred in

the Hazara district, the numbers being 16,835 cases in 1904-05 and 26,417 in 1905-06, but of the total increase, over 7,000 were revaccinations. The result in Hazara is no doubt in a measure due to the number of vaccinators having been increased in April 1905 from three to six. Large increases also occurred in the Dera Ismail Khan and Kohat districts. Vaccination work is conducted in the Kurram and Tochi agencies and the sub-agency of Chitral, the best work being done in the first-mentioned. Efforts are to be made to introduce vaccination into other political agencies, but the local administration doubts if they will be attended with much success. The special vaccinator entertained for the Sherani Country succeeded in vaccinating 3,843 persons, and in the Amb territory 1,249 operations were performed by a vaccinator of the Hazara district. Both Sherani and Amb are foreign territory.

On an estimated birth-rate of 40 per mille, 58·92 per cent. of the infants were protected against 52·48 per cent. in the preceding year. The Vaccination Act is now in force in all save two of the municipal towns of the province, and the question of extending the Act to these two is again to be urged. The number of infants successfully vaccinated in those two towns was, however, fairly satisfactory. In all the towns a mean of 72·3 per cent. of the available number of infants were successfully vaccinated.

The vast majority of vaccination operations were performed with animal lymph, human lymph hardly being used except in the Sherani Country and the Kurram Valley. In Peshawar vaseline lymph and glycerine lymph were largely used owing to the difficulty of obtaining buffalo calves in the district. The requirements of lymph for the province are met by obtaining preserved lymph from the Punjab Vaccine depôt at the beginning of the season and vaccinating buffalo calves; this secures a good supply during the rest of the year. The idea of establishing lymph depôts in the province has been abandoned in view of the economical and satisfactory arrangement for obtaining requirements from the Punjab Vaccine depôt.

The cost of the department was, £776, as compared with £748 in the preceding year, but the cost of each successful case fell from $2\frac{5}{12}$d. to 2d.

Central Provinces and Berar.—The total figures relating to vaccination in the Central Provinces and Berar include the work done in the Feudatory States and at dispensaries. The figures for 1905-06 exclude those of the Sambalpur district which has been transferred to Bengal, and also of the Native States transferred to that province for which figures were not forthcoming. The figures for 1904-05, where used for comparison, also exclude the Sambalpur district.

The total number of operations conducted in the province during 1905-06, numbered 626,138 against 597,177 in 1904-05, of which 551,140 were primary cases and 74,998 revaccinations, the corresponding figures for the preceding year being 540,187 and 56,990, respectively. The percentage of success was 98·59 in primary cases and 72·30 in revaccinations. Excluding Feudatory States, 559,443 persons were vaccinated against 539,516 in 1904-05, and of the former 491,818 were primary cases and 67,625 re-vaccinations; the percentages of success were 97·26 and 62·83, respectively. The increase in primary work of about 6,000 cases is attributed to the high birth-rate of the year, and in revaccinations of about 14,000 cases, to the efforts made to induce people to get themselves revaccinated, aided in some districts by the prevalence of small-pox. In the Feudatory States 59,322 primary vaccinations were performed compared with 54,334 in 1904-05, and 7,373 revaccinations compared with 3,327. The percentage of success claimed was 96·81 against 97·09 in primary cases and 84·03 against 85·75 in revaccinations.

On the whole 44·81 per mille of the population were successfully vaccinated in 1905-06, as compared with 42·83 per mille in 1904-05 which, bearing in mind the prevalence of plague in many parts of the province during the year, is considered to be satisfactory.

Estimating the birth-rate at 40 per mille of the population, 76·75 per cent. of the infants were successfully vaccinated and in municipalities 96·93 per cent. of the number available.

The various kinds of lymph used during the year were fresh calf lymph 32,536 cases (93·48 per cent. successful), glycerine calf lymph 502,401 cases (93·14 per cent. successful), human lymph 19,555 cases (97·60 per cent. successful) and lanoline

lymph 4,951 cases (68·79 per cent. successful). The use of glycerine calf lymph has steadily increased, but it is not explained why the percentage of success with it, which was 96·14 in 1904-05, fell to 93·14 in the year under report.

The cost of the department was £4,425 or £267 more than in 1904-05 the increase being due to various causes. Each successful case cost $1\frac{1}{2}$d. in both years. In the Feudatory States, the department cost £317 or £20 more than in 1904-05, but the cost of each successful case fell to $1\frac{1}{4}$d. from $1\frac{1}{3}$d.

Madras.—The total number of vaccination operations performed by all agencies in the Presidency numbered 1,464,990 during 1905-06. Primary cases showed a decrease of 49,244 and revaccinations an increase of 30,965 during the year, leaving a net decrease of 18,279 operations compared with the work done in 1904-05. It is satisfactory, however, to record that the total number of successful vaccinations, which had been 1,242,717 in 1904-5, rose to 1,296,312 in 1905-06, while the percentages of success in primary cases and in re-vaccinations rose from 87·38 and 74·51 to 92·67 and 76·02, respectively. The explanation of the decreased outturn of work in some districts is the short supply of vaccine paste from the King Institute and the absence of vaccinators without substitutes being appointed. In regard to the shortage of the paste supply during certain months of the year, it has been ascertained that it was due to the unfavourable state of the season in the Chingleput district and to the poor condition of the calves.

On the estimated birth-rate of 40 per mille, 30·09 per cent. of the infants were successfully vaccinated, which shows an improvement on the rates of 28·29 and 27·57 recorded in 1904-05 and 1903-04, respectively; in municipalities 67·9 per cent. of the available infants were protected against 66·5 per cent. in the preceding year.

Lanoline lymph, manufactured at the King Institute, Madras, was used exclusively in local fund areas with a percentage success of 92·3, against 86·6 in the previous year, and almost exclusively in the municipalities with a percentage success of 95·6. Nearly 600 operations were performed in municipalities with lanoline lymph supplied by the Bangalore Institute, the percentage of success being 96·7. Locally prepared glycerine lymph was also used in municipalities and was successful at the rate of 99·4 per cent. The results during 1905-06, from the lanoline paste prepared at the King Institute show a marked improvement on those during 1904-05, which is accounted for by the vaccinators having become more familiar with the use of the lymph. A Deputy Inspector of Vaccination was deputed to give instruction in the use of this description of lymph in the more backward districts.

The cost of the department which had been £18,491 in 1904-05, rose to £19,628 during 1905-06, and the cost of each successful case rose by $\frac{1}{12}$d. to $3\frac{2}{3}$d.

Coorg.—In Coorg the increase in the number of vaccinations during 1904-05 was more than maintained during 1905-06, a total of 11,291 operations having been performed of which 9,306 were primary operations and 1,985 revaccinations, showing increases of 405 and 508, respectively, on the figures of the preceding year. The percentage of success in primary cases was 93·21 compared with 95·99 in 1904-05, and in revaccinations 76·26 compared with 86·43. Calf lymph was used, but no reason is given for the decline in the ratios of success.

The cost of the department was £183, or a little below the sum of £185 spent in 1904-05, and each successful case cost $4\frac{1}{2}$d. or $\frac{1}{6}$d. less than in the previous year.

Bombay.—The steady increase of vaccination work which has taken place in the Presidency during recent years, was not continued during 1905-06, when the total number of operations was 656,338 compared with 669,007 in 1904-05. The decrease occurred in the Western, Central and Presidency Circle registration districts, the explanation offered being the large number of persons vaccinated in the previous year owing to the prevalence of small-pox, and an adverse season in the Central registration district scattering the people. Of the 656,338 operations performed, 610,985 were primary cases and 45,353 revaccinations, the corresponding figures for 1904-05 being 607,064 and 61,943, respectively, so that the net decrease of the year was brought about by the smaller number of revaccinations. The percentages of success in 1905-06 were somewhat lower than in the previous year—primary cases 97·56 against 98·52, and revaccinations 76·13 against 79·12.

On the estimated birth-rate of 40 per thousand of population, 52·32 per cent. of the infants were protected against 52·99 per cent. in the previous year, but according to the provincial Sanitary Commissioner's calculation of births *minus* deaths of infants under one year of age, 81·08 per cent. of the infants available were protected.

Vaccination was conducted from calf to arm, with glycerinated calf lymph and with lanolinated vaccine: in Sind, except for a few operations, the arm-to-arm process was employed. In the Southern registration district, vaccination with preserved lymph manufactured at the Vaccine Depôt, Belgaum, was carried on successfully, and in the words of the Deputy Sanitary Commissioner "the increase in the work cannot be attributed to a fall in the epidemicity of plague but rather to vaccination with preserved vaccine lessening the difficulties confronting the vaccinator, and also possibly to the new method being more popular with the people." After trials at the Vaccine Depôt at Belgaum with various kinds of lymph, it has been decided to adopt chloroformed glycerine lymph which was largely used in the Southern registration district and is being gradually introduced into the other districts.

The cost of the department rose from £19,028 in 1904-05 to £20,087 in 1905-06; the cost of each successful case in those years being $7\frac{3}{4}$d. and $8\frac{1}{4}$d., respectively.

Burma.—In Burma the total number of vaccination operations was 488,927 or 75,924 more than in 1904-05. Of the total operations, 426,935 were primary cases and 61,992 revaccinations, compared with 380,686 and 32,317, respectively, in the previous year, so that there was an increase in both classes of work, the number of revaccinations being almost doubled. The percentage of success was also higher, in primary cases 90·80 in 1905-06 compared with 84·67 in 1904-05, and in revaccinations 53·33 compared with 47·99. The Rangoon municipality contributed 24,081 cases to the increase in the total of the previous year "largely due to belated vigour in vaccinating, following the severe epidemic of small-pox which prevailed during the year."

The vaccine used was bovine lymph obtained from the Meiktila Vaccine depôt, except in Rangoon where lymph, the quality of which is condemned by the provincial Sanitary Commissioner, is prepared at a local depôt. The lymph supplied by the Meiktila depôt was satisfactory; it was of three descriptions, viz., lanoline vaccine, glycerinated-vaccine and quinated-vaccine. Major Entrican, I.M.S., who is in charge of the depôt, found that in point of duration of vitality lanoline is preferable as a medium, but that in the unskilled vaccinators' hands the more fluid glycerine forms are more readily manageable. Arrangements are to be made for the new vaccination staff to be entertained to be given a course of training at the Meiktila Vaccine Depôt in theoretical and practical vaccination and allied subjects and better results may, therefore, be anticipated.

The cost of the department rose from £6,677 in 1904-05 to £7,631, but the cost of each successful case fell to $4\frac{3}{4}$d. from $5\frac{1}{6}$d. in the year before.

Ajmer-Merwara.—In this small province the total vaccination operations showed a trifling increase from 14,713 operations in 1904-05 to 14,935 in 1905-06. The primary cases numbered 14,510 or 300 more than in the previous year, and revaccinations 425 or 78 less. The percentage of success in primary cases was 95·50 against 99·08 per cent. in 1904-05 and in revaccinations 81·65 against 86·28 per cent.

The department cost £190 and each successful case $3\frac{1}{12}$d. in 1905-06, as compared with £177 and $2\frac{11}{12}$d. respectively, in 1904-05.

Sanitary Works.

Bengal.—In the province of Bengal before the partition there were, excluding Calcutta, 161 municipalities and their income in 1904-05, excluding an opening balance of £62,956 was £385,153 or £18,608 more than in the previous year. Of the total income 36·40 per cent. was spent on sanitary works, 12·48 per cent. on roads, 5·66 per cent. on public safety and 31·63 on other requirements. The actual expenditure on sanitation included £20,967 on water supply, £13,439 on drainage, and £90,719 on conservancy.

The expenditure on water-supply was £8,099 less than in 1903-04 as a result of the large capital expenditure in that year; on conservancy and drainage expenditure increased by sums of £3,977 and £2,306, respectively.

There is evidence of considerable activity in municipal sanitation in Bengal; water supplies are being improved, drainage schemes undertaken and conservancy improved. Attention has been focussed upon the biological method of disposing of sewage on account of the objections raised to the discharge into the river of effluents from the installations attached to the mills on the banks of the Hooghly, and Dr. Gilbert Fowler of Manchester was engaged by the Government of Bengal to enquire into the matter. He arrived at the end of the year and his report is awaited. In the meantime Captain Clemesha, I.M.S., the Sanitary Commissioner, succeeded in devising a method for the practical sterilisation of effluents by the use of chloride of lime.

The work of the different district boards has mainly had to do with measures for the prevention of plague and cholera, sanitary arrangements at fairs, clearance of jungle in the neighbourhood of villages and the improvement of local drainage.

There were two meetings of the Sanitary Board during the year; but, as usual, most of the work was carried on by the circulation of files among the members. The more important matters considered at the meetings were the appointment of an Assistant Sanitary Engineer, the Monghyr waterworks project, the Howrah drainage project, and the modification of the rules for the preparation of drainage and water-supply schemes.

Preliminary estimates were prepared for the Monghyr waterworks to cost £20,867, of which it is proposed to raise £15,258 by local subscriptions; and for the Rampur-Boalia waterworks, the water to be pumped from a large well for which a suitable site has been found.

Detailed estimates were prepared for the Barisal waterworks and the Khulna filtered water-supply scheme. Among the schemes considered during the year were the Howrah drainage project, the Garulia drainage project, the Baranagore drainage scheme, the Titaghar drainage scheme, the Budge-Budge drainage scheme, the Cossipur-Chitpur drainage scheme, drainage schemes for Puri, Berhampore, Uttarpara, Deoghar, Khulna, and Azimgunge, and schemes for the improvement of the water-supply of Kurseong and the supply of unfiltered water to Cossipur-Chitpur.

The scheme for the supply of filtered water to Faridpur proved so successful that, at the instance of the Commissioner of the Dacca division, the Board, with the sanction of Government, distributed the design and estimate of cost of the filter beds to all the small municipalities. The scheme is very simple; it consists of a tank with two filter beds on the bank, a clear water reservoir fitted with taps and arrangements for pumping.

Eastern Bengal and Assam.—The new province was constituted after the end of the financial year to which this section relates, and the facts regarding the income and expenditure of most of the municipalities are included in the details given under Bengal. In Eastern Bengal and Assam there are 44 municipalities, two stations, Shillong and Sibsagar, and three unions, Jorhat, Golaghat, and Habiganj. The total income excluding opening balance was £86,328, of which 41·71 per cent. was spent on sanitary works of one kind or another.

A Sanitary Board was formed, consisting of the Senior Member of the Board of Revenue, the Chief Engineer and Sanitary Commissioner, but no meeting was held.

United Provinces.—Municipal sanitation continues to make rapid progress in these provinces. The water-supply works at Agra, Allahabad, Benares, Cawnpore, Lucknow, and Meerut gave excellent results throughout the year, and extensions were made and improvements introduced in most cases. At Meerut where the water is taken from an irrigation canal, the water was of most excellent quality, the result of the examination of 268 samples showing an average of 2·76 microbes per c.c. One of the filters in which the rate of filtration is controlled by a special metre devised by the Sanitary Engineer, Mr. Aikman, gave even better results, the average number of microbes per c.c. being only 1·46. At Naini Tal, where the pumps had to be worked throughout the year on account of scanty rainfall, there was a considerable increase in expenditure owing to more coal being required and to some new machinery being necessary. At Mussoorie the scheme for extending the water-supply and introducing electric lighting is in progress.

Good progress was made with the drainage and sewage works at Benares, Cawnpore, and Agra. At Agra the sullage is run on to a sandy island in the bed of the river and is used to irrigate crops of tobacco which promise to repay the cost of the sullage farm. At Lucknow the drainage works have been pushed on rapidly; 829 acres have been completely paved and 29,941 feet of underground storm-water sewers have been built. During the year nearly 44 miles of drains were completed, and about six miles of streets paved. The Sanitary Engineer draws special attention to the excellent, economical and rapid work that has been done at Lucknow by Messrs. Lane Brown and Hewlett.

At Mirzapur the drainage works were nearing completion. They have been carried out with the greatest economy and praise is bestowed by the Sanitary Engineer on Mr. O'Brien, the municipal engineer, for the excellence of his work. A scheme for waterworks for the town is in contemplation.

The projects for the drainage of Budaun, Hathras, and Moradabad were nearing completion; and those for the drainage of Azamgarh, Firozabad, Khurja, and Huldwani were completed. Surveys are in progress in Hapur, Etawah, Saharanpur, and Gorakhpur, and were about to be undertaken in Amroha and Sambhal. The preparation of schemes for Muttra and Brindaban, Jaunpur, Ghazipur, Padrauna, and Bahraich has been assigned to Mr. Lane Brown. Experiments were carried out to ascertain the best methods of treating, and the time required in the processes for the treatment of domestic sewage and sullage, with encouraging results, and it is hoped that it will soon be possible to introduce septic tank latrines and bacteria beds which will give an effluent which can be discharged into open drains without nuisance.

The Sanitary Board held four meetings during the year when they approved projects, the estimates for which amounted to £125,677, an increase of 22 per cent. over the total of 1904 and of about 28 per cent. over the total of 1903.

The necessity for appointing an assistant to the Sanitary Engineer was admitted and Government addressed.

Punjab.—No information is given in the provincial report regarding the income of the municipal towns. At Lahore the daily consumption of water has risen rapidly in the last three years, due, it is believed, to leakage from the mains and to the extravagant irrigation of gardens. A complete scheme for the provision of waste meters was prepared and accepted by the Municipal Committee and the Sanitary Board, but nothing has been done owing to want of funds. An estimate for the extension of the well system at the head works to cost £5,220 was prepared for the Committee. Estimates for a conservancy tramway (£3,623) to carry night soil and refuse to a depôt at a distance from the city, and for improving the drainage outfall (£1,276) of the civil station, were prepared.

At Delhi good progress was made with the intramural drainage.

At Amritsar progress was made with the intramural drainage works; eleven projects to cost £6,553 for the drainage of different parts of the town were made over to the Municipal Committee. A committee was assembled to report on the best means of disposing of sewage at the outfall: it was resolved that land should be acquired to be let out to tenants. At Ambala the water-supply was increased by deepening five of the old wells; and the intramural drainage works were nearly completed. At Rawal Pindi the scheme for the construction of main intercepting drains and disposal works at a cost of £9,264 was in progress. At the new town,

Sargoda, the water-supply and drainage works were nearly completed. At Ludhiana an estimate of £26,667 for the construction of waterworks was sanctioned by the Local Government. At Multan the main drain and disposal works were well advanced. At Ferozepore and Muktesar the extramural drainage and disposal works were completed.

At Gujrat good progress was made with the extramural drainage and disposal works. A preliminary estimate for the drainage of Gurdaspur was prepared, and the detailed estimate for the Jagraon drainage works sanctioned.

At Simla arrangements were made to check the waste of water, new mains were laid down, and estimates for the construction of reservoirs to store storm water for flushing sewers were sanctioned. A Committee, appointed to enquire into the sanitary condition of the station, reported favourably on the water-supply and sewerage arrangements and recommended numerous improvements.

The provincial sanitary commissioner draws special attention to the gratifying increase in the amount of land used for the disposal of municipal sullage, &c., and to the higher price paid for sullage.

The Board met five times during the year. The following schemes were examined by them and submitted to the local Government for sanction. (1) Drainage scheme for Chiniot at a cost of £4,022; (2) Drainage scheme for Jagraon to cost £1,633; (3) Improvement of the drainage of Logarh gate at a cost of £1,848, and re-construction of drains, Lahori gate section, Amritsar city, at a cost of £685; (4) Water-supply scheme for Ludhiana at a cost of £26,667; (5) Metering the city and civil station pipe lines at Lahore, £1,495; and (6) Suburban drainage scheme for Delhi, £25,290. All except the last, which was under consideration, were sanctioned.

It was decided by the local Government to delegate to the Sanitary Board the power to sanction grants-in-aid from provincial revenues when necessary, within the limits of the sum allotted each year for the purpose, and the following instructions, along with a form drawn up by the Board calling for particulars of the financial condition, &c., of municipalities applying for aid, were issued to the district officers concerned.

(1) The Board shall examine the financial position of the local body concerned and decide whether it is possible for the project to be carried out entirely at the expense of the ratepayers with or without a loan.

(2) If it is decided that the project can be financed by a loan, the Board shall, in the case of all *large* municipalities, refer them to the instructions of Government regarding the raising of loans in the open market and recommend them to carry out the necessary negotiations; in the case of smaller municipalities the Board shall decide whether the cost of the project is or is not too heavy to be borne by the local body even with the assistance of a loan; in coming to a decision on this point the possibility of financing the project by a resort to increased taxation shall be carefully considered.

(3) If the local body is unable either by a loan, increased taxation or otherwise to finance the project, the Board shall decide whether the work is so important and useful that it ought not to be postponed.

North-West Frontier Province.—No sanitary work of great importance was carried out during the year, but many minor improvements were made in the various towns. At Peshawar where sanitary measures are energetically pushed forward, the following sums were spent: £688 on extension of the water-supply; £1,948 on drainage; £107 on paving streets. The sum derived from the sale of manure increased by £243 to £901.

Central Provinces and Berar.—The income of the headquarters' municipalities in 1904-05, excluding opening balances and special grants, was £88,237, of which 34·24 per cent. was spent on sanitation, including water-supply, drainage, conservancy, markets, slaughter houses, &c.; 5·77 per cent. on medical relief and epidemics (including 1·17 on plague) and ·16 per cent. on vaccination.

No original work of any importance was carried out during the year, and the money spent was devoted to the improvement or repair of existing water-supply works, the extension and renewal of drains and the like.

The Sanitary Board met at each district headquarters. The work carried out under their auspices consisted as usual in the improvement of village sites and surroundings, the construction of new walls and the repair of old ones.

Madras.—Including the presidency town there are 61 municipalities in Madras, but no information is furnished in the provincial report regarding their incomes or their expenditure on sanitary improvements, except that 39 failed to expend a fair share of the year's allotment. At Guntur the water-supply works were completed at a cost of £14,733 and opened on the 10th July. The water is brought by a masonry conduit from springs at the foot of the Kondavidu hills five miles from the town; at present the supply is equal to four gallons a head only.

At Coonoor the water-supply works estimated to cost £8,213 were opened in April. Estimates for the expenditure of £3,322 on extensions were sanctioned, and progress was made with the work. At Dindigul the scheme to supply water from the Oodukam valley by gravitation at a cost of £3,460 was completed in March. At Vellore the estimate was again revised to include compensation for the removal of three villages situated in the catchment area and now amounts to £25,168: pipes and other materials were delivered and the work was in progress. At Saidapet and Negapatam works of a more or less experimental character in connection with water-supply schemes were carried out. At Ootacamund stoneware pipes, &c., were ordered for the drainage works and work was commenced principally on the laying out of the sewage farm.

Schemes for the water-supplies of Salem and Coimbatore and for the drainage of Madura were examined during the year, and a number of additional schemes either complete with plans and estimates or in the form of reports with approximate estimates were submitted, the more important of which were the Ellore waterworks, Cocanada water-supply extension, Anantapur water-supply improvement, Masulipatam water-supply, Kottagiri water-supply, Periyakulam water-supply, Tuticorin water-supply extension, Negapatam drainage, Cuddapah drainage, and Madras water-supply improvement. It is proposed to substitute a masonry conduit for the existing open channel which conveys the Red Hills water to the City of Madras, and to provide filter beds and pumping power. The estimated cost of the scheme, which was being considered by the local Government, is £150,000.

The total sum assigned by District Boards to be spent on sanitation was £58,277, and nearly half of this sum was used during the last nine months of the year.

The Board examined the plans relating to 101 sanitary works estimated in the aggregate to cost £423,870. Of these 66 were finally approved, 21 were completed during the year, 26 were in progress and 18 were deferred for want of funds.

Bombay.—The income of the 162 municipalities in Bombay—the presidency town is excluded—in the year ending 31st March, 1905, was £456,665, and £124,192 was spent on the improvement of water-supply, drainage, and conservancy within municipal limits. No new scheme of water-supply or drainage was undertaken during the year, the reason given being the embarrassed condition of municipal funds on account of expenditure in connection with plague. The entire income of district and local Boards was £292,286, of which £18,644 was devoted to water-supply and drainage.

The Board met once during the year and considered the question of financial and technical assistance to be rendered to municipalities so as to stimulate progress in sanitary improvement. The Board submitted recommendations on the subject to the local Government.

At Ahmedabad nearly £100,000 has been spent on sewerage works which will serve rather more than a third of the total area and nearly half the total population. Further expenditure of £100,000 will apparently be necessary to complete the work. The water-supply works require extension and improvement at an estimated cost of £23,333. At Karachi the drainage extension works were commenced during the year. At Poona alterative projects for improving water-supply were considered, and detailed estimates for the comprehensive scheme including the city and cantonments and Kirkee were being prepared. The preparation of a revised scheme of drainage for Poona city was taken in hand. At Surat steps were taken

to improve the existing water-supply; and at Hyderabad the municipality is arranging to provide a new settling tank. Projects for completing the water-supply works and surface drainage of Pandharpur were being worked out.

Burma.—The income of all the municipalities in the province was £462,387, of which the following percentages were spent on sanitation—on water-supply 13, on drainage 8, on conservancy 12, on other sanitary works 12; but on account of the unusual outlay in Rangoon on the Hlawga water-supply project, the provincial Sanitary Commissioner suggests that a more correct idea of the average expenditure on sanitation will be obtained if the expenditure in the municipalities of the Pegu division is omitted. When this is done the percentages are on water-supply ·78, on drainage 3·80, on conservancy 12·16, and on other sanitary works 4·66. The total income of the town funds was £28,276, of which 21 per cent. was spent on conservancy, 2 per cent. on drainage, 4 per cent. on water-supply, and 18 per cent. on other sanitary works. Of the district funds, aggregating £316,542, rather less than 5 per cent. was devoted to purposes of sanitation.

At Rangoon the Hlawga well works were opened on the 22nd February, but the supply was not satisfactory and it was found that the expectations entertained of it would not be fulfilled. An expert committee was appointed and their report is reassuring; improved means of distribution will be required and increased pumping power, when, it may be hoped, that certain minor alterations will ensure an abundant supply.

At Moulmein the water-supply works were completed, but it appears that the piped supply has to compete with many defective wells. At Mandalay "the question of water-supply is still pending." Estimates for water-supplies were sanctioned for Akyab (£19,928), Rangoon Cantonment and Thonzé and prepared for Kyauktan, Thatôn and Meiktila. At Rangoon the question of providing an improved system of sewage disposal was carefully considered by the committee and an estimate of £34,695 was sanctioned by the local Government. The reclamation of land is proceeding. The provision of adequate house room for the growing population is becoming a serious matter. The remodelling of the existing building regulations has received consideration by the committee, but it is reported that they have not "approached the subject with that determination to face vested interests that is essential in dealing with a matter of this nature, if solid sanitary results are hoped for." Drainage schemes are in progress at Pegu and Insein. Preliminary estimates for drainage and conservancy schemes for Kyaiklat and Pyapon were prepared.

The Sanitary Board held two meetings during the year. At the first the constitution and functions of the Board were discussed, with the result that the constitution of the Board has been altered and its functions defined. In future it will consist of the Financial Commissioner, the Chief Engineer, the Sanitary Commissioner, and the Sanitary Engineer, the last named to be the Secretary. Commissioners, Deputy Commissioners, and Civil Surgeons will be *ex-officio* members when the Board meet in their division. The Board will meet at least four times a year and their functions will be "purely consultative." They are, however, required to report to Government any case of persistent disregard of their advice. At the second meeting of the Board the principal subject considered was proposed rules for the guidance of the Sanitary Engineer.

General Remarks.

Red Sea Pilgrim Traffic.—The Government of India notified in September, 1904, that, as the detention of pilgrims for ten days in observation camps at or near the ports of embarkation had proved costly and inconvenient to the pilgrims, it had been decided, with the concurrence of His Majesty's Government, that the period of observation should be reduced to five days at a central camp, from which, after satisfactory medical inspection and disinfection, pilgrims would be permitted to proceed to the Hejaz. The Haj was open to any resident in India, but embarkation was permitted from Bombay only; embarkation from Chittagong being discontinued because of the unlikelihood of pilgrims desiring to embark from this port if they could do so from Bombay. The warning given the previous year that intending pilgrims would be well advised to defer the fulfilment of their purpose until another year, was repeated.

In this report it is possible to notice the results of the pilgrim season of 1904-5 only, to which the orders referred to above relate; complete information for the season 1905-6 is not yet available. In view, however, of the change made in the conditions under which pilgrimage is to be permitted for the season 1906-7, and the fact that the orders were issued prior to the appearance of this report, it may here be mentioned that the conditions for the pilgrim season 1905-6 were the same as those for the season 1904-5, but for the season 1906-7, the Government of India notified at the end of September, 1906, that (1) no person shall be permitted to embark for a pilgrimage to Mecca except at Bombay; (2) all ships chartered for Jeddah shall be thoroughly cleansed and freed from rats by the Clayton process under the personal directions of the Port Health Officer; (3) ample hospital accommodation shall be provided on board; (4) before embarkation pilgrims shall be medically inspected and their clothes and baggage disinfected as in the case of third-class passengers on ordinary steamers; (5) the ships shall undergo further medical inspection both at Aden and at Perim; and (6) in the event of plague appearing on board a vessel arriving at Aden, telegraphic information shall be sent to Perim where the persons attacked shall be landed and placed in a plague camp; cases of the disease occurring between Aden and Perim shall be dealt with similarly, the ship being allowed to proceed to Kamaran.

The importance of the latest orders to the Moslem community in India lies in the fact that since the Government of India notification of the 20th February, 1897, suspending pilgrimage to Mecca, and the subsequent notification of the 20th November of the same year, permitting it, pilgrimage has every year since then been subject to medical observation of the pilgrims prior to embarkation. For the past two seasons that period has been restricted to five days only, and now medical observation prior to embarkation has been entirely abolished.

During the season 1904-5, a total of 12,449 pilgrims embarked in 15 ships at Bombay; of these the Kamaran report for that year records the arrival of 11,242, while the Haj report states that there arrived at Jeddah 11,820 Indian pilgrims, of whom 11,339 proceeded direct by pilgrim ships from Bombay and 481 adopted indirect routes. The pilgrimage of 1904-5 was a smaller one than that of the preceding year which was a Haj Akbar (grand pilgrimage).

The observation camp at Bombay was opened on the 20th October, 1904, the first ship leaving five days later and the last on the 13th January, 1905. During the voyage there were 16 deaths on eight ships, and 20 persons were landed at Aden, most of them on account of small-pox. During the period of quarantine at Kamaran 33 pilgrims died, six of them from small-pox, and 100 were admitted to hospital chiefly on account of acute and chronic respiratory diseases. The Vice-Consul remarks with satisfaction that the orders regarding the detention at Kamaran of sick pilgrims after the completion of the regulation period of quarantine have been relaxed and greater discretion was being exercised in the matter. In the Haj report it is stated that "the health of the pilgrims was perfect throughout the season," and that the sanitary condition of both Jeddah and Mecca has greatly improved within the last few years.

The pilgrims returned to Bombay between the 21st February and the 2nd September, 1905; in all 13,952 arrived in 25 ships. During the voyage to Bombay

there were 120 deaths on 10 ships, seven being due to small-pox; 11 ships furnished between them 35 cases of small-pox; of those on board infected ships, 325 were vaccinated, the rest refusing vaccination. The clothing and bedding of 5,648 pilgrims among whom small-pox appeared were disinfected before disembarkation was permitted; the other pilgrims who were found free from infectious diseases were landed immediately on arrival at Bombay and taken charge of by the Protector of Pilgrims who arranged for the despatch by rail of all pilgrims to their homes.

Malta Fever.—During the past year a considerable amount of original work has been done in connection with Malta fever and our knowledge of this disease, especially as regards its dissemination, has been much increased thereby. These researches have for the most part been carried out by the Mediterranean Fever Commission, working under the supervision of an advisory committee of the Royal Society.

The result of the Commission's work are here shortly summarised. The *M. melitensis* shows no sign of being able to lead a saprophytic life; outside the body it can retain its vitality for a long period, but it does not multiply. Many domestic animals—goats, cows, mules, horses, dogs, &c., are found to suffer naturally from the disease and of these the goat seems the most susceptible. It is found that about 50 per cent. of the milch goats in Malta suffer from the disease and about 10 per cent. (some apparently healthy) are excreting the specific microbe in the milk. Excretion in milk may continue for three months without any physical changes in the milk or any sign of ill-health in the goat. In this connection Zammit's test (the *milk* instead of the *blood* reaction with *M. melitensis*) is not only a good indicator of infection but is a surer test than the ordinary serum reaction that the micrococcus is being excreted in the milk. It was demonstrated that the milk of goats that are infected and have a marked blood reaction may not necessarily contain the micrococcus, and that, in the milk of a goat, the blood serum or milk of which has no agglutinative action, the micrococcus is not found. In the milk the excretion of the micrococcus (which has been shown to persist in the blood of a goat for seven months) may be intermittent. The goat is less susceptible to the disease than the monkey, and the monkey than man. In man the micrococci can be demonstrated in the peripheral blood in 68 per cent. of cases, but they are never very numerous in the blood; the smallest quantity of blood in which the micrococcus has been found is 4 c. mm., *i.e.*, in the proportion of one micrococcus to about 20,000,000 red corpuscles.

In the various experiments carried out by the Commission with expired air, saliva, sputum, sweat, scrapings of the skin and fæces, the micrococcus was never detected; we must, therefore, turn to the urinary passages in the hopes of finding an important channel of elimination. In the urine, the micrococcus is found from about the 15th day of illness till after convalescence is established and in this way hands, food, and dust may become infected. Elimination in urine may be intermittent or continuous. Ambulant cases are common, amounting to 10 or 15 per cent. of the entire native population in Malta; and the ambulant cases who are excreting the *M. melitensis* in their urine and are thus a possible danger to the community, constitute 1 or 2 per cent. This urine is infective to monkeys and goats.

There is a close correspondence between atmospheric temperature and incidence; on the other hand, incidence has no intimate connection with rainfall. Although Malta fever is least prevalent in the cold months, the number of cases which do occur in winter actually amount to about one-third of those recorded in the hot months—July, August and September—the season of greatest incidence.

Animals, chiefly monkeys and goats, have been infected by the respiratory and digestive tracts by using infected dust and infected food. With regard to the former, Bruce states that, as the experiments were with dust artificially contaminated with cultures and so with a very concentrated virus, there is no absolute proof that dust as it occurs under natural conditions ever conveys the disease to the healthy, and adds that "theoretically there seems to be danger from the scattering broadcast of such a virulent and resistant microbe, but it is possible that not a single case of infection occurs in this way." There is no such doubt about infection by the digestive tract. Monkeys fed on naturally infected goats' milk, *i.e.*, on the

ordinary milk of goats in the streets under natural conditions, have become infected. The injection of the virus under the skin of man or monkey or the application of the virus to a scratch gives rise to the disease. Infected dust or liquids applied to unbroken conjunctiva, nasal passages, pharynx or larynx may also lead to infection. Horrocks and Kennedy state that it is "extremely probable that human beings are infected by the bites of infected mosquitoes." They report three experiments which suggest the possibility of the disease being transmitted in this manner; yet many other experiments have been carried out on the same lines with negative results. Experiments, so far, are not conclusive and they do not prove that mosquitoes or other biting insects can infect man or animals. Davies and Johnstone seem to think that mediate contagion, *e.g.*, pollution of hands and food, play a significant part in dissemination. Horrocks says that infection cannot occur from contact with the cutaneous surface of a patient, unless that surface is contaminated with urine.

The incubation period is considered to be from 6 to 30 days or more. The general impression amongst Maltese medical men is that the usual incubation period is not more than 8 or 10 days. Horrocks gives the following figures: if infection is by subcutaneous injection or through a crack in skin or mucous membrane, the incubation period is from 5 to 7 days; if through unbroken mucous membrane, such as by feeding with infected goats' milk, the period may even extend to two months.

The prophylactic measures put forward chiefly concern urine, goats' milk and mosquitoes. Immediate and complete disinfection of clothing, bedding, bed-pans, and utensils soiled by Malta fever patients is recommended: urinals and latrines should be properly managed; milk pasteurised (68° C. for 10 minutes) or boiled; mosquitoes and infected goats destroyed; and Malta fever patients isolated in hospital.

Surgeons Ross and Levick, R.N., reasoning by a process of exclusion, have all along held that infection is carried chiefly by mosquitoes and other biting insects. Their work, appearing before the Commission's suspicions had been directed towards mosquitoes, was opportune and threw considerable doubt on the goats' milk theory at a time when it was almost generally believed that the Commission had found the key to the prophylaxis of Malta fever. These naval surgeons did not believe infection could be acquired through uninjured respiratory or digestive tracts. They drank water and goats' milk containing *M. melitensis* in large numbers and did not contract the disease. They pointed out that the disease was as prevalent as ever in Malta after care was being taken to sterilise milk; that the one regiment which did not boil its milk had the lowest admission rate; that in hospitals, where all milk was carefully sterilised, the incidence had increased. They criticised the food and dust experiments of the Commission on the grounds that the incubation periods were so very long; that the monkeys had to be fed for weeks before they contracted the disease as shown by the agglutination test, and even then there might be no sign of ill-health and the monkeys sometimes actually gain in weight; whereas, the inoculation of the minutest amount of virus under the skin gave rise to the disease in 6 days. They held that, when such enormous and unnatural quantities of infected material were used repeatedly over such a considerable length of time, lesions of mucous membrane may meanwhile have occurred and infection may not have occurred until a lesion had become inoculated. They maintain that the incubation period of natural infection (mosquitoes) is from 8 to 11 days.

It is recognised that there is more than one factor responsible for the spread of this disease and in the present state of our knowledge attention is directed chiefly to (1) goats' milk, (2) contamination—especially with urine—of hands, food and other articles and (3) mosquitoes. Of these the most important would seem to be goats' milk, and, up to the present, this is the only means by which we have little doubt the disease can be conveyed to man. As evidence of this the following instances collected by Bruce may be cited. (1) The introduction of Maltese goats into Rhodesia was followed by an outbreak of Malta fever. (2) In 1905 the S.S. "Joshua Nicholson" shipped 65 goats at Malta for export to America. The milk was drunk by the crew with the result that an epidemic of Malta fever broke out on board. (3) Strachan in the Orange River Colony blamed goats' milk for causing an outbreak of Malta fever at certain farms, and Birt found that the blood

of some of the goats of these farms gave the serum reaction with *M. melitensis*. (4) Forster isolated *M. melitensis* from the milk of one of the goats kept for supplying milk to a Malta fever stricken regiment at Ferozepore (Punjab). (5) Davies found that children in Malta who drank unboiled milk suffered four times as much as those who drank boiled milk.

Malta fever has during the past year been demonstrated to be endemic not only in India but also in South Africa and possibly in Egypt. Birt in the Orange River Colony, at first by a well controlled serum test, and subsequently by isolating *M. melitensis*, has shown that this fever is endemic in that region. Phillips has reported cases at Cairo: the serum reaction was positive in very high dilution, but no mention is made of the isolation of the micrococcus. In last year's report a full account was given of the history of Malta fever in India up to the work of Lamb proving the endemicity of the disease in this country. Recently Forster, at Ferozepore (Punjab), examined the herd of goats from which milk was being supplied to the 14th Sikhs, who had suffered considerably from the disease. He found that 10·5 per cent. of the goats gave the serum reaction and isolated the *M. melitensis* from the milk of one of them.

Reid reports great benefit from therapeutic inoculations, the dose of vaccine being regulated by observing the opsonic power of the blood, and suggests this method of inoculation for prophylaxis. Shaw (Commission) has drawn attention to the persistence of the living *M. melitensis* in the blood of goats for at least seven months and the bearing this persistence has upon the preparation of a therapeutic serum.

The Pasteur Institute, Kasauli.—The steady increase in the number of patients resorting to the Institute for anti-rabic treatment continued during the year ending August 8, 1906. A total of 1,262 persons presented themselves for treatment, of whom 117 were not treated, as there was satisfactory evidence that the animals that inflicted the bites were not rabid. Of the 1,145 persons treated, 342 were Europeans and 803 natives, compared with 307 Europeans and 570 natives in the previous year. Patients came from every province, from the native states of Rajputana and Kashmir, one from Sikkim, two from Ceylon and one from the Persian Gulf. Included in the total were 172 patients from the British army and 82 from the Native army. Of the total number treated there were seven failures only.

Besides anti-rabic treatment, bacteriological examinations of specimens, serum diagnosis, &c., were carried out, the number of cases thus furnishing material for examination being 880; further, in 277 instances experiments were carried out to prove the existence or otherwise of rabies in animals dead with suspicious symptoms.

The duty of preparing sera was transferred from the Pasteur Institute to the Central Research Institute in December, 1905; between the 9th August and the end of November, 1905, 410 bottles of antivenene and 312 bottles of antidiphtheritic serum were issued from the Pasteur Institute.

Research Laboratories.—The *Central Research Institute* at Kasauli is situated well away from other buildings in the cantonment. The Institute consists of ten substantial stone buildings; the main one, which was formerly an official residence, has been considerably altered to adapt it for the purposes of a laboratory, while the others have been built for the various purposes for which they are required. The main building has a large hall running through the centre and is surrounded by a wide verandah; the flooring is of glazed tiles; in all the rooms gas light is available and in some electric light as well. The building contains about 21 rooms which have been allotted for various purposes, such as microscopic work, photography, library, offices, &c. The subsidiary buildings, or blocks, are used for housing animals, preparing sera and storing chemicals and spare apparatus; one block is fitted up with a 10½ H.P. oil engine, a dynamo, an electric storage battery of 56 cells, a freezing machine and cold storage room, and another with a Mansfield gas installation; there are also quarters for 12 servants. A piped water-supply has been laid on to four of the ten buildings. The Institute has been fully equipped with all necessary apparatus and can accommodate six to eight workers. Two officers of the Indian Medical Service have received a two months' course of instruction in technique, qualifying them for investigations connected with malaria, *kala azar* and blood diseases generally.

The *King Institute of Preventive Medicine*, at Guindy, about six miles from Madras City, is divided into two sections—the vaccine and the bacteriological. The buildings occupy an extensive site; on the east are the bacteriological laboratories, animal house and experimental sewage disposal works; in the centre the numerous smaller buildings of the vaccine section, and on the west the quarantine and isolation sheds of the vaccine section and two laboratory blocks with stables designed for serum work. In the grounds are quarters for the superintendent, the deputy superintendent and a European subordinate. The chief laboratories are located in a large building with open corridors and wide verandahs. The laboratories and the rooms of the manufacturing block of the vaccine section are floored with smooth Cuddapah slab and have white glazed tiled walls, while the fittings are of polished black stone or of glass; the floors of each stall in the calf sheds consist of a single partially polished Cuddapah slab which is kept scrupulously clean day and night by men told off for that purpose. The laboratories are fitted with electric fans worked by a gas engine and dynamo. The water is supplied under pressure from cisterns on the roof, the pumping station being situated at no great distance. The Institute has been fully equipped for preparing vaccine and conducting the bacteriological work of the presidency and also serves as a centre of training for sanitary assistants, vaccinators and plague inspectors to whom both practical and theoretical instruction is imparted. The laboratories are available for the instruction of officers and the carrying out of research work by them.

The *Pasteur Institute for Southern India* is located at Coonoor. Besides the main building which stands in a large compound, there are the necessary outbuildings which include quarters for a hospital assistant and servants, stables for horses, houses for rabbits, and godowns for stores and apparatus. The main building is a two-storied one, with a central corridor running from end to end. On the ground floor are the work rooms (rooms for the preparation and preservation of the virus, patients' waiting and inoculation rooms, surgery, &c.) and clerks' office: on the upper floor, on one side, are the director's office, the library and store rooms, and on the other, residential quarters which will probably be allotted to the assistant director. Gas and water pipes are to be fitted to the building which is nearing completion; it is expected that the Institute will be ready to receive patients for treatment in February next.

• *Facilities for Research or Instruction at Laboratories.*—With a view to supplementing the work of the bacteriological laboratories in the investigation of Indian diseases, it has been arranged that officers of the Indian Medical Service who may volunteer, and officers of the Royal Army Medical Corps, who are recommended by the Principal Medical Officer in India, may be allowed to proceed to a laboratory for a period of three to six months for the purpose of prosecuting research already commenced or for instruction in technique, provided local arrangements can be made for the conduct of routine duties during their absence. While at a laboratory, officers will draw their ordinary pay, less any local allowances, and will be granted travelling allowances; no deputation allowance will be admissible.

Special Enquiries.—In addition to routine work at the bacteriological laboratories, special enquiries have been commenced with reference to typhoid fever in India, dysentery in jails and lunatic asylums, and malaria in the Presidency division of Bengal, and the inquiry into the etiology of *kala-azar* has been continued.

Typhoid Fever.—In March, 1906, the staff of the Central Research Institute, Kasauli, commenced an investigation in connection with the etiology and spread of enteric fever in India. Work was begun with material available in Kasauli and its vicinity, and during the winter of 1906-7 the investigations are to be conducted in the cantonment of Meerut, the staff of the Central Research Institute being strengthened temporarily by the deputation of specially selected officers to assist in the enquiry.

Dysentery.—This is the most serious cause of mortality in Indian prisons, and it has been known for many years that the term dysentery in the returns included several diseases presenting nearly identical signs and symptoms although arising from different causes. In order to further investigate the matter the Government of India placed Captain W. C. H. Forster, I.M.S., on special duty under the Sanitary Commissioner, to investigate the causation, prophylaxis and treatment of dysentery

in the prisons and lunatic asylums of India. Captain Forster has been authorized to visit a certain number of jails in the several provinces, and also lunatic asylums, and carry out researches therein. The results of Captain Forster's investigations will, it is hoped, add to the existing knowledge of one of the most fatal of tropical diseases.

Malaria.—The Government of Bengal recognised in their Resolution No. 1379-Medical, dated the 26th March, 1906, that over a large part of the province, and particularly in the Presidency division, a main cause of ill-health is the obstruction of drainage. A complete remedy was not held to be possible, but it was considered certain that in many places the conditions could be greatly ameliorated by the execution of drainage projects which could be carried out without excessive expenditure. A local committee of three members was appointed to visit the districts of the Presidency division (1) to ascertain what areas are specially unhealthy; (2) to investigate the cause of the prevalent sickness and in particular to determine how far this prevalence is due to obstructed drainage; (3) to consider if a drainage scheme is practicable; and (4) to prepare a list of practicable drainage schemes in their order of urgency. To assist the committee with expert knowledge the services of Captain G. E. Stewart and Lieutenant A. H. Proctor, I.M.S., have been lent temporarily to the local Government.

Kala Azar.—Contributions to our knowledge of the Leishman-Donovan body are conspicuously absent from the parasitological literature of the year, and it appears as if observers were awaiting the discovery of the extra-corporeal stage of the parasite to renew their labours.

The reports for 1903 and 1904 contain a history of the discovery of the parasite and of the growth of knowledge concerning it, and the present time seems opportune to summarize what is now known regarding it.

The prominent clinical features of *kala azar* are a characteristically irregular temperature, progressive cachexia and splenic enlargement, conditions which have given rise to the names "malarial cachexia," "cachectic fever," and "tropical splenomegaly." In the early stages of the disease it sometimes resembles enteric fever, but the febrile attacks are often followed by periods of apparent perfect health; as the disease progresses profound cachexia supervenes; diarrhœa, *cancrum oris*, *cancrum vulvæ*, transient œdemas, petechial eruptions, pigmentary changes and ulcers of the skin are of more or less constant occurrence. The disease is common and particularly severe in Assam, where it has long been well known clinically, but it has a wide distribution within the tropics and cases have been reported among other countries from Africa, Malaysia and China. The parasite of *kala azar* is, as we have seen, morphologically identical with the parasite of the chronic granuloma of the skin known as Delhi boil; whether there is any difference between the parasites, as might be expected from the geographical distribution of the two diseases, the future will, no doubt, disclose.

The parasite of *kala azar* is a circular body, 2—3μ in diameter, formed of a clear homogeneous cytoplasm, in which are embedded close to the periphery two conspicuous chromatin masses resembling the chromatin masses of a trypanosome. The smaller mass is a blepharoplast from which there often stretches a short "tail" of chromatin. The existence of double forms makes it probable that the parasites reproduce themselves in the body by binary fission. Circular bodies giving rise by multiple fission to from 3 to 8 parasites occur, but the stages of their formation have not yet been completely followed. The parasite is nearly always embedded in the cytoplasm of some kind of cell, generally in the endothelial cells of the viscera, but also in leucocytes. Large macrophages, probably of endothelial origin, containing as many as two hundred parasites are found in cases of *kala azar* and of Delhi boil.

In *kala azar* the parasites are present in enormous numbers in the spleen, liver and bone-marrow, and they are also found in the intestinal walls, in the lymphatic glands, kidneys and testicles. In advanced cases, they are to be found in the leucocytes in the peripheral circulation, and in petechial hæmorrhages in the brain membranes. They are present in granulation tissue wherever it occurs, and in papules of the skin. In Delhi boil the parasites are packed in the cells of the granulation tissue in such numbers as to give rise to an appearance under the microscope of a section of the spleen in *kala azar*.

It was shown by Rogers that, if splenic blood, taken from a case of *kala azar*, is prevented from clotting by the addition of citrate of soda solution, and is kept at a temperature of 22° C.-24° C., the parasites enlarge, the protoplasm becomes granular, and the chromatin masses assume a more central position: repeated fission then occurs and most of the forms develop a thick flagellum, those parasites resembling a typical flagellate. The question now is, "what happens next?"

Researches regarding the extra-corporeal life of the parasite are being pursued by Captain Patton, I.M.S., who has been attached to the King Institute at Guindy for the purpose of this investigation. It was found by Christophers and by Donovan that in certain cases a considerable number of the parasites was present in the leucocytes of the peripheral blood, and it was suggested by the former that this distribution might be concerned in the dissemination of the disease. Captain Patton has found that the parasite is frequently found in the peripheral blood—so frequently that an examination of the blood is of considerable diagnostic value, and that the number of parasites in the blood may be very great, as many as 80 being found in one case in a single film. He has found that, although ordinarily in *kala azar* there is leucopenia, when diarrhœa is present there is almost always leucocytosis with the abundant presence of parasites in the peripheral blood. Founding a hypothesis upon this fact and upon the process of development *in vitro*, Captain Patton conducted a long series of feeding experiments with mosquitoes, lice and bugs, and found that parasites could be recovered from the gut of the bug four days after feeding and that they showed in some cases the changes characteristic of development.

It is as yet doubtful if this fact indicates the bug as the carrier of *kala azar*; and Rogers' experiments, showing that the bodies develop best in an acid medium, do not incriminate the bug more than other blood-sucking insects. For the present we must be content to know that the work of Rogers and Patton favours the view that infection may be carried from cases in which the peripheral circulation is loaded with parasites by a blood-sucking insect. The fact that in cases in which diarrhœa is severe the peripheral circulation contains many parasites throws a new light upon Bentley's statement that dysenteric cases are chiefly concerned in the spread of the disease.

Standing Committee on Enteric Fever in India.—In July, 1906, the Government of India, on the recommendation of His Excellency the Commander-in-Chief, approved the formation of a standing committee for the purpose of investigating and advising on the incidence of enteric fever in India and its prophylaxis. The committee is composed of the Principal Medical Officer, His Majesty's Forces in India, as President (*ex-officio*), a Vice-President and five members drawn from medical officers in military employ, with the Sanitary Officer, Army Headquarters, as member and Secretary. The Government of India decided that their Sanitary Commissioner and the Director of the Central Research Institute, with Major G. Lamb, I.M.S., and Captain E. D. W. Greig, I.M.S., should also be members of the committee. The committee held their first meeting at Simla on July 31, 1906, and following days, His Excellency the Commander-in-Chief opening the proceedings in person, and the second meeting, also at Simla, on October 17, 1906, and subsequent days.

Scientific Memoirs.—Since the issue of the last report the following memoirs have been published:—No. 21, "On the Standardisation of Anti-typhoid Vaccine," by Captains G. Lamb and W. H. C. Forster, I.M.S.; No. 22, "Mediterranean Fever in India; Isolation of the Micrococcus Melitensis," by Captain G. Lamb, I.M.S., and Assistant Surgeon M. Kesava Pai; No. 23, "The Anatomy and Histology of Ticks," by Captain S. R. Christophers, I.M.S.; No. 24, "On a Parasite found in the White Corpuscles of the Blood of Palm Squirrels," by Captain W. S. Patton, I.M.S.; No. 25, "On the Importance of Larval Characters in the Classification of Mosquitoes," by Captain S. R. Christophers, I.M.S.; No. 26, "Leucocytozoon Canis," by Captain S. R. Christophers, I.M.S.

JOHN T. W. LESLIE, Lieutenant-Colonel, I.M.S.,
Sanitary Commissioner with the Government of India.

Statistical Tables, 1905.

Table No.				Page
I.—European Troops.—Summary.—A.—Sickness and Mortality by Commands and Divisions				127
			B.—Sickness and Mortality by Geographical Groups	127
II.	„	„	Ratios of Commands	128
III.	„	„	„ „ Geographical Groups	129
IV.	„	„	Strength, Admissions, &c., from all causes and from Enteric Fever, by Age and Length of Residence	130
V.	„	„	Admission and Death Rates in Stations of over 1,000 Strength	130
VI.	„	„	Arrivals, Age, and Length of Residence in relation to Venereal Diseases and Enteric Fever	130
VII.	„	„	Relation of Mortality to Age and Length of Residence	131
VIII.	„	„	„ „ Invaliding „ „ „	132
IX.	„	„	Statistics of Officers.—A.—Sickness and Mortality among Officers of British Army	133
			B.—Causes of Death among Officers of British and Indian Armies	133
X.—Native Troops. — Summary.—A.—Sickness and Mortality by Commands and Divisions				134
			B.—Sickness and Mortality by Geographical Groups	134
XI.	„	„	Ratios of Commands	135
XII.	„	„	„ „ Geographical Groups	136
XIII.	„	„	Sickness and Mortality in Plains and Hills	137
XIV.—Prisoners.—Summary.—A.—Sickness and Mortality by Administrations				138
			B.— „ „ „ „ Geographical Groups	138
XV.	„		Ratios of Administrations	139
XVI.	„	„	„ Geographical Groups	140
XVII.—General Population.—Provincial Birth and Death Statistics				141
XVIII.	„	„	Births	141
XIX.	„	„	Deaths by Provinces	142
XX.	„	„	„ in Towns and Rural Circles	142
XXI.	„	„	„ according to Age	142
XXII.	„	„	„ „ „ Cause	143
XXIII.	„	„	„ by Months	143
XXIV.	„	„	Ratio of Deaths according to Months	143
XXV.	„	„	Deaths from Cholera, by Provinces, 1885–1905	144
XXVI.	„	„	„ „ „ by Months, in 1905	144
XXVII.	„	„	Details of Distribution and Occurrence of Cholera in 1905	144
XXVIII.	„	„	Small-pox Mortality	145
XXIX.	„	„	Fever Mortality	146
XXX.	„	„	Mortality from Dysentery and Diarrhœa	147
XXXI.	„	„	„ „ Plague	148
XXXII.	„	„	„ „ Respiratory Diseases	148
XXXIII.	„	„	Vaccination	149

EUROPEAN TROOPS.

TABLE I.—SUMMARY, SICKNESS AND MORTALITY.

A.—COMMANDS AND DIVISIONS.	Years.	Average Strength.	RATIO PER MILLE OF STRENGTH.												
			Admissions into Hospital.	Constantly Sick.	Deaths.	Invaliding.	Deaths from								
							Cholera.	Small pox.	Enteric fever.	Heat-stroke.	Tubercle of the lungs.	Pneumonia.	Dysentery.	Abscess of the liver.
Northern Command	1904	18,297	881	53	11·15	34	—	·05	4·26	1·04	·49	·87	·22	·87
	1905	18,274	801	49	9·08	20	—	—	3·12	1·15	·27	·82	·05	·44
Western Command	1904	19,699	909	60	12·39	44	·30	—	3·96	·25	·61	·51	·41	1·88
	1905	19,537	896	55	11·62	29	·10	·05	3·69	·51	·41	·67	·72	1·64
Eastern Command	1904	18,648	887	59	11·10	31	·21	·16	4·34	·32	·21	·21	·70	1·56
	1905	18,983	820	54	10·90	19	·11	—	3·11	1·00	·37	·47	·42	1·42
1st (Peshawar) Division	1904	2,662	740	44	10·52	36	—	—	3·01	1·50	·38	1·13	—	·75
	1905	2,767	1,031	54	13·37	23	—	—	5·06	2·89	·36	·72	—	·36
2nd (Rawalpindi) „	1904	6,933	777	51	10·53	33	—	·14	4·62	·29	·29	·58	·43	·87
	1905	6,881	743	47	8·72	15	—	—	3·63	·58	·15	·58	—	·44
3rd (Lahore) „	1904	8,702	1,006	57	11·84	33	—	—	4·37	1·49	·69	1·03	·11	·92
	1905	8,627	773	50	8·00	24	—	—	2·09	1·04	·35	1·04	·12	·46
4th (Quetta) „	1904	4,230	784	59	5·44	66	—	—	1·18	—	·24	·47	·24	·71
	1905	4,322	1,024	60	12·03	50	—	·23	4·63	·23	—	1·39	·93	1·16
5th (Mhow) „	1904	7,051	1,095	65	15·18	33	—	—	6·67	·43	—	·43	·85	1·99
	1905	7,310	891	51	11·63	19	—	—	4·51	·41	·27	·14	·96	2·05
6th (Poona) „	1904	7,051	800	58	13·05	34	·85	—	3·40	—	1·42	·57	·14	2·27
	1905	6,955	816	55	9·63	21	—	—	2·30	·43	·86	·86	·29	1·29
7th (Meerut) „	1904	8,998	845	57	10·89	26	—	·22	4·67	·33	·33	·22	·89	1·45
	1905	8,590	777	52	10·24	18	—	—	4·19	·93	·12	·47	·23	·93
8th (Lucknow) „	1904	9,652	926	61	11·29	35	·41	·10	4·04	·31	·10	·21	·52	1·66
	1905	10,393	856	55	11·45	20	·19	—	2·21	1·06	·58	·48	·58	1·83
9th (Secunderabad) „	1904	8,226	914	61	7·29	44	—	—	3·28	—	—	·24	·12	1·34
	1905	8,389	813	62	8·46	18	—	—	2·62	·48	—	·36	·60	1·79
Burma Division	1904	3,782	1,099	67	9·25	27	·26	—	·26	·26	·53	·53	·79	·79
	1905	3,812	971	54	9·71	15	1·31	—	·79	·26	—	1·05	1·31	·26
Aden Brigade	1904	1,367	906	52	16·09	91	—	—	1·46	1·46	·73	·73	—	2·93
	1905	947	948	66	24·29	63	—	—	3·17	3·17	—	—	1·06	3·17
INDIA	1904	71,083	900	57	10·83	35	·15	·06	3·76	·49	·38	·52	·42	1·36
	1905	71,343	834	52	10·05	21	·13	·01	2·99	·77	·28	·63	·46	1·16

B.—GEOGRAPHICAL GROUPS.	Years.	Average Strength.*	RATIO PER MILLE OF STRENGTH.												
			Admissions.	Constantly Sick.	Admissions from										
					Influenza.	Cholera.	Small-pox.	Enteric fever.	Intermittent fever.	Remittent fever.	Simple continued fever.	Pneumonia.	Dysentery.	Venereal diseases.
Group I.—Burma Coast and Bay Islands	1894-1903	1,143	1,350	90	45·3	·1	·3	8·2	181·9	6·0	46·6	1·5	46·2	507·0
	1904	1,099	1,469	90	10·3	—	—	7·3	111·0	14·6	99·2	2·7	22·7	419·5
	1905	1,259	1,221	52	·8	—	2·4	·8	27·0	26·2	135·8	2·4	35·7	236·7
„ II.—Burma Inland	1894-1903	2,391	1,431	92	3·4	·3	·2	4·3	323·9	21·3	48·7	2·3	25·5	447·2
	1904	2,338	918	58	·4	—	—	2·6	154·8	2·1	17·5	1·3	9·8	275·0
	1905	2,063	823	51	1·9	—	—	2·9	155·6	3·4	65·0	3·4	5·8	157·5
„ IV.—Bengal and Orissa	1894-1903	2,163	1,376	83	7·8	1·0	·2	10·6	362·2	34·5	20·7	2·6	68·2	412·1
	1904	1,617	1,244	83	29·7	1·9	1·2	5·6	155·2	28·4	44·5	1·9	16·7	369·2
	1905	1,690	1,160	77	60·4	—	—	7·7	255·6	4·7	21·3	4·7	21·3	241·4
„ V.—Gangetic Plain and Chutia Nagpur.	1894-1903	6,693	1,262	89	9·5	4·9	1·1	28·6	216·9	7·6	47·2	2·3	29·4	446·7
	1904	6,707	919	60	2·7	—	·6	29·8	129·3	2·4	69·3	1·5	20·0	175·0
	1905	7,315	801	51	1·9	·3	·1	17·4	95·4	2·5	104·4	1·8	12·9	152·3
„ VI.—Upper Sub-Himalaya	1894-1903	12,880	1,355	84	3·7	·7	·5	24·6	395·3	9·6	19·7	6·2	21·2	365·5
	1904	13,776	919	56	13·1	—	·7	27·5	208·8	1·4	15·3	3·0	11·4	176·8
	1905	13,724	816	53	15·5	—	·3	23·3	74·6	2·2	53·6	5·4	9·0	139·0
„ VII.—North-Western Frontier, Indus Valley, and North-Western Rajputana.	1894-1903	4,791	1,490	79	2·0	·1	·7	19·2	573·8	41·1	26·7	6·8	18·0	299·6
	1904	4,905	813	53	—	—	·4	7·3	198·0	5·1	28·5	4·5	4·7	162·3
	1905	5,068	1,093	57	93·7	—	1·0	18·9	190·8	·2	64·5	7·1	7·7	130·2
„ VIII.—South-Eastern Rajputana, Central India, and Gujarat.	1894-1903	5,892	1,555	98	2·7	1·1	·8	34·6	430·1	10·8	30·4	3·2	23·2	479·6
	1904	6,238	1,110	69	1·0	—	2·4	26·1	292·7	3·2	8·0	3·5	13·3	270·6
	1905	6,562	820	51	5·0	—	3·8	16·8	161·5	6·4	8·7	4·4	12·3	173·7
„ IX.—Deccan	1894-1903	9,371	1,258	84	10·2	·8	·6	20·8	251·5	7·1	24·7	2·4	26·7	458·8
	1904	10,029	869	55	—	1·2	1·0	21·3	158·1	5·5	15·8	3·5	16·0	201·7
	1905	10,434	807	52	6·1	·2	3·6	24·6	107·0	·5	41·9	3·5	19·5	165·3
„ X.—Western Coast	1894-1903	1,573	988	69	1·1	·1	·3	6·4	132·1	7·8	34·7	2·7	13·9	354·0
	1904	1,645	846	61	1·2	—	—	3·0	97·9	·6	1·8	1·2	6·1	303·3
	1905	1,591	855	58	7·5	—	5·7	1·3	152·1	3·8	1·9	3·1	6·3	243·2
„ XI.—Southern India	1894-1903	3,270	1,192	75	9·5	·3	·7	14·5	152·2	8·2	44·0	2·8	29·4	421·8
	1904	3,791	882	51	1·3	—	—	23·7	102·1	1·8	7·4	2·4	14·5	209·2
	1905	3,738	795	55	—	·3	2·4	13·1	91·0	—	15·2	·5	16·6	209·5
„ XIIa.—Hill Stations	1894-1903	8,778	1,026	70	6·0	·3	·1	29·4	166·7	8·1	14·7	5·2	17·0	321·8
	1904	10,772	724	47	5·1	·1	·2	14·7	68·0	2·0	31·0	5·1	6·7	170·3
	1905	10,508	755	45	5·5	—	·1	10·9	60·0	·3	53·6	5·8	10·6	122·5
„ XIIb.—Hill Convalescent Depôts and Sanitaria.	1894-1903	3,075	1,226	84	6·4	·2	·1	15·3	281·2	8·2	9·4	4·3	21·1	295·0
	1904	3,551	952	72	6·2	—	—	23·4	207·5	1·7	16·1	5·4	11·5	181·6
	1905	3,512	819	60	3·1	—	·3	9·7	121·0	·9	13·1	1·1	13·4	140·1
INDIA	1894-1903	66,581	1,293	80	6·3	1·0	·5	23·0	311·2	13·5	27·2	4·3	27·5	385·5
	1904	71,083	900	57	4·9	·2	·7	19·6	174·0	3·4	23·7	3·4	12·6	198·5
	1905	71,343	834	52	14·2	·1	1·4	16·1	111·4	2·3	47·9	4·1	13·4	153·7

* The decennial ratios are worked on the total strength of the ten years period.

European Troops.

Table II.—Ratios of Commands, 1905.

	Ratios per 1,000 of the Average Strength.					
	Northern Command.	Western Command.	Eastern Command.	Secunderabad Division.	Burma Division.	India.*
I.—Strength	18,274	19,537	18,983	8,389	3,812	71,343
II.—†Constantly-sick-rate of each Month—						
January	64·9	57·9	62·5	82·8	56·6	56·4
February	48·1	54·4	56·7	59·2	58·9	52·3
March	39·7	52·2	46·2	56·1	52·6	47·0
April	37·9	45·8	47·5	56·8	49·1	44·8
May	48·7	47·5	45·6	60·8	51·6	48·7
June	51·3	50·9	50·4	59·0	50·5	51·7
July	54·8	52·1	53·4	60·2	52·3	54·1
August	52·3	61·0	56·6	62·2	58·8	57·3
September	46·0	62·7	54·8	66·0	54·7	55·5
October	43·2	59·9	54·5	65·1	48·5	52·4
November	52·4	59·2	61·8	58·9	58 1	54·7
December	58·3	56·7	56·1	57·3	59·1	53·4
Of the Year	49·3	55·0	53·6	61·6	54·0	52·3
III.—Admission-rate of the Year—						
Influenza	35·4	7·3	11·2	·1	1·3	14·2
Cholera	—	·1	·1	·1	—	·1
Small-pox	·3	3·9	·1	1·2	·8	1·4
Enteric fever	17·7	17·5	16·9	16·3	2·4	16·1
Intermittent fever	69·6	162·8	113·2	77·7	114·4	111·4
Remittent fever	·5	2·8	2·6	·1	10·5	2·3
Simple continued fever	63·4	42·4	48·0	20·0	80·5	47·9
Tubercle of the lungs	1·7	3·0	1·8	1·1	3·9	2·1
Pneumonia	5·7	4·7	3·2	1·4	2·9	4·1
Other respiratory diseases	20·2	26·4	22·5	20·1	30·7	23·0
Dysentery	6·5	17·2	12·6	18·7	15·5	13·4
Diarrhœa	14·0	16·2	19·6	5·8	17·1	15·2
Hepatic abscess	1·3	2·9	2·4	2·7	·5	2·1
„ congestion and inflammation	23·4	14·4	19·8	9·3	11·3	17·1
Venereal diseases	116·1	155·4	165·8	194·1	207·0	153·7
All Causes	800·5	896·4	820·2	812·8	970·9	834·3
IV.—Death-rate of the Year—						
Cholera	—	·10	·11	—	1·31	·13
Small-pox	—	·05	—	—	—	·01
Enteric fever	3·12	3·69	3·11	2·62	·79	2·99
Intermittent fever	·05	·20	·11	·12	—	·11
Remittent fever	—	—	·05	—	—	·01
Simple continued fever	—	—	—	—	—	—
Heat-stroke	1·15	·51	1·00	·48	·26	·77
Circulatory diseases	·49	·67	·63	·24	·52	·56
Tubercle of the lungs	·27	·41	·37	—	—	·28
Pneumonia	·82	·67	·47	·36	1·05	·63
Other respiratory diseases	—	—	·21	—	—	·06
Dysentery	·05	·72	·42	·60	1·31	·46
Diarrhœa	—	—	—	—	—	—
Hepatic abscess	·44	1·64	1·42	1·79	·26	1·18
All Causes	9·08	11·62	10·90	8·46	9·71	10·05
V.—Percentage in 100 Admissions—						
Influenza	4·42	·81	1·36	·01	·14	1·70
Cholera	—	·01	·01	·01	—	·02
Small-pox	·04	·44	·01	·15	·08	·17
Enteric fever	2·21	1·95	2·06	2·07	·24	1·93
Intermittent fever	8·69	18·16	13·80	9·56	11·78	13·35
Remittent fever	·07	·31	·32	·01	1·08	·27
Simple continued fever	7·92	4·73	5·86	2·46	8·30	5·74
Tubercle of the lungs	·21	·34	·22	·13	·41	·25
Pneumonia	·71	·53	·39	·18	·30	·50
Other respiratory diseases	2·53	2·94	2·74	2·48	3·16	2·76
Dysentery	·81	1·92	1·54	2·30	1·59	1·61
Diarrhœa	1·75	1·80	2·40	·72	1·76	1·83
Hepatic abscess	·16	·33	·29	·34	·05	·26
„ congestion and inflammation	2·93	1·60	2·42	1·14	1·16	2·05
Venereal diseases	14·51	17·34	20·21	23·87	21·32	18·42
VI.—Percentage in 100 Deaths—						
Cholera	—	·9	1·0	—	13·5	1·3
Small-pox	—	·4	—	—	—	·1
Enteric fever	·34·3	31·7	28·5	31·0	8·1	29·7
Intermittent fever	·6	1·8	1·0	1·4	—	1·1
Remittent fever	—	—	·5	—	—	·1
Simple continued fever	—	—	—	—	—	—
Heat-stroke	12·7	4·4	9·2	5·6	2·7	7·7
Circulatory diseases	5·4	5·7	5·8	2·8	5·4	5·6
Tubercle of the lungs	3·0	3·5	3·4	—	—	2·8
Pneumonia	9·0	5·7	4·3	4·2	10·8	6·3
Other respiratory diseases	—	—	1·9	—	—	·6
Dysentery	·6	6·2	3·9	7·0	13·5	4·6
Diarrhœa	—	—	—	—	—	—
Hepatic abscess	4·8	14·1	13·0	21·1	2·7	11·7

* Including troops on the line of march and the Field Force.

† Worked on the aggregates.

EUROPEAN TROOPS.

TABLE III.—RATIOS OF GEOGRAPHICAL GROUPS, 1905.

	RATIO PER 1,000 OF THE AVERAGE STRENGTH.												
	I.	II.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.*a*	XII.*b*	
	Burma, Coast and Bay Islands.	Burma Inland.	Bengal and Orissa.	Gangetic Plain and Chutia Nagpur.	Upper Sub-Himalaya.	North-West Frontier, Indus Valley, and North-West Rajputana.	South-East Rajputana, Central India, and Gujarat.	Deccan.	Western Coast.	Southern India.	Hill Stations.	Hill Convalescent Depôts and Sanitaria.	India.
I.—STRENGTH	1,259	2,063	1,690	7,315	13,724	5,068	6,562	10,434	1,591	3,738	10,508	3,512	71,343
II.—*CONSTANTLY-SICK-RATE OF EACH MONTH—													
January	59·4	52·9	86·6	50·6	69·6	54·6	69·8	54·5	70·2	108·8	55·5	66·2	56·4
February	57·4	55·3	81·9	50·6	50·8	48·9	58·0	52·1	63·0	56·1	46·1	68·4	52·3
March	55·0	50·0	75·8	42·2	40·4	43·4	51·1	50·3	75·7	47·6	36·4	63·6	47·0
April	49·8	43·4	70·7	46·8	44·2	39·3	45·9	44·0	45·2	47·7	36·6	52·0	44·8
May	40·4	51·9	59·5	45·6	51·1	63·7	48·3	44·8	41·8	51·1	38·7	59·6	48·7
June	38·9	47·0	60·7	55·9	52·2	62·0	47·4	45·5	45·8	53·7	45·6	61·9	51·7
July	46·9	46·3	71·1	58·4	58·7	74·8	43·9	46·9	59·4	55·1	47·3	58·3	54·1
August	64·5	51·0	103·2	51·8	59·6	80·7	47·0	57·8	65·4	50·7	48·3	59·8	57·3
September	48·8	52·4	100·8	54·4	52·9	69·6	52·8	60·4	64·3	53·9	44·2	58·8	55·5
October	34·3	54·7	78·8	51·7	49·1	58·2	48·4	58·9	73·9	54·8	45·4	59·1	52·4
November	64·3	49·2	76·4	56·8	51·5	57·6	61·4	56·2	43·5	52·5	70·6	78·7	54·7
December	63·6	53·8	63·7	55·8	57·5	57·3	60·1	52·4	55·1	50·8	50·4	63·2	53·4
OF THE YEAR	51·7	50·6	77·3	51·4	52·5	57·2	52·7	52·1	58·3	54·7	45·4	60·4	52·3
III.—ADMISSION-RATE OF THE YEAR—													
Influenza	·8	1·9	60·4	1·9	15·5	93·7	5·0	6·1	7·5	—	5·5	3·1	14·2
Cholera	—	—	—	·3	—	—	—	·2	—	·3	—	—	·1
Small-pox	2·4	—	—	·1	·3	1·0	3·8	3·6	5·7	2·4	·1	·3	1·4
Enteric fever	·8	2·9	7·7	17·4	23·3	18·9	16·8	24·6	1·3	13·1	10·9	9·7	16·1
Intermittent fever	27·0	155·6	255·6	95·4	74·6	190·8	161·5	107·0	152·1	91·0	60·0	121·0	111·4
Remittent fever	26·2	3·4	4·7	2·5	2·2	·2	6·4	·5	3·8	—	·3	·9	2·3
Simple continued fever	135·8	65·0	21·3	104·4	53·6	64·5	8·7	41·9	1·9	15·2	53·6	13·1	47·9
Rheumatic fever	·8	—	·6	·3	·3	·4	·5	·3	—	—	·7	·6	·4
Tubercle of the lungs	8·7	1·5	3·6	2·2	1·6	2·4	1·8	2·6	1·3	1·3	1·4	2·3	2·1
Pneumonia	2·4	3·4	4·7	1·8	5·4	7·1	4·4	3·5	3·1	·5	5·8	1·1	4·1
Other respiratory diseases	31·8	27·6	42·0	19·5	19·1	28·0	18·1	19·5	19·5	14·7	30·3	35·9	23·0
Dysentery	35·7	5·8	21·3	12·9	9·0	7·7	12·3	19·5	6·3	16·6	10·6	13·7	13·4
Diarrhœa	23·8	14·5	23·7	11·5	13·2	10·3	14·9	12·7	17·6	6·7	26·7	18·8	15·2
Hepatic abscess	—	—	3·6	3·1	1·3	1·0	2·6	3·5	3·8	1·3	1·3	3·7	2·1
„ congestion and inflammation.	7·9	11·6	26·0	20·9	28·9	10·7	14·9	12·9	15·1	10·4	14·6	12·2	17·1
Venereal diseases	236·7	157·5	244·4	152·3	139·0	130·2	173·7	165·3	243·2	209·5	122·5	140·1	153·7
ALL CAUSES	1,220·8	823·1	1,160·4	800·8	815·5	1,092·7	820·2	806·8	854·8	795·3	754·5	818·9	834·3
IV.—DEATH-RATE OF THE YEAR—													
Cholera	—	2·42	—	·27	—	—	—	·19	—	—	—	—	·13
Small-pox	—	—	—	—	—	·20	—	—	—	—	—	—	·01
Enteric fever	·79	·48	·59	2·87	4·23	3·75	4·88	3·55	·63	1·87	2·76	·85	2·39
Intermittent fever	—	—	·59	·14	—	·20	—	·10	—	·27	—	—	·11
Remittent fever	—	—	—	—	·07	—	—	—	—	—	—	—	·01
Simple continued fever	—	—	—	—	—	—	—	—	—	—	—	—	—
Heat-stroke	—	·48	1·18	1·23	1·02	1·78	1·07	·29	1·89	·27	·10	—	·77
Circulatory diseases	—	—	—	·96	·58	·59	·61	·10	·63	·54	·67	·28	·56
Tubercle of the lungs	—	—	1·1	·55	—	·20	·48	·29	—	—	·10	·28	·28
Pneumonia	·79	1·45	1·78	·14	·66	·59	·30	·58	·63	·27	1·14	·57	·63
Other respiratory diseases	—	—	·59	—	·07	—	—	—	—	—	·10	·28	·06
Dysentery	3·18	—	1·78	·27	·15	—	·30	·96	—	—	·67	·85	·46
Diarrhœa	—	—	—	—	—	—	—	—	—	—	—	—	—
Hepatic abscess	—	—	2·96	1·50	·44	·59	1·68	1·73	1·26	1·07	·86	2·28	1·18
ALL CAUSES	7·15	8·73	17·75	10·25	10·27	10·66	11·89	10·16	9·43	6·42	8·95	9·11	10·05
V.—PERCENTAGE IN 100 ADMISSIONS—													
Influenza	·07	·24	5·20	·24	1·90	8·58	·61	·76	·88	—	·73	·38	1·70
Cholera	—	—	—	·03	—	—	—	·02	—	·03	—	—	·02
Small-pox	·20	—	—	·02	·04	·09	·46	·45	·66	·30	·01	·03	·17
Enteric fever	·07	·35	·66	2·17	2·86	1·73	2·04	3·05	·15	1·65	1·45	1·18	1·93
Intermittent fever	2·21	18·90	22·03	11·92	9·15	17·46	19·70	13·26	17·79	11·44	7·95	14·78	13·35
Remittent fever	2·15	·41	·41	·31	·27	·02	·78	·06	·44	—	·04	·10	·27
Simple continued fever	11·13	7·89	1·54	13·04	6·58	5·90	1·06	5·19	·22	1·92	7·10	1·60	5·74
Rheumatic fever	·07	—	·05	·03	·04	·04	·06	·04	—	—	·09	·07	·05
Tubercle of the lungs	·72	·18	·31	·27	·20	·22	·22	·32	·15	·17	·19	·28	·25
Pneumonia	·20	·41	·41	·22	·66	·65	·54	·44	·37	·07	·77	·14	·50
Other respiratory diseases	2·60	3·36	3·62	2·44	2·34	2·56	2·21	2·41	2·28	1·85	4·01	4·38	2·76
Dysentery	2·93	·71	1·84	1·60	1·11	·70	1·50	2·41	·74	2·09	1·40	1·63	1·6
Diarrhœa	1·95	1·77	2·04	1·43	1·62	·94	1·82	1·57	2·06	·84	3·54	2·29	1·83
Hepatic abscess	—	—	·31	·39	·16	·09	·32	·43	·44	·17	·18	·49	·26
„ congestion and inflammation.	·65	1·41	2·24	2·61	3·55	·98	1·82	1·60	1·76	1·31	1·93	1·50	2·05
Venereal diseases	19·39	19·14	21·06	19·02	17·05	11·92	21·18	20·49	28·46	26·34	16·23	17·11	18·42
VI.—PERCENTAGE IN 100 DEATHS—													
Cholera	—	27·8	—	2·7	—	—	—	1·9	—	—	—	—	1·3
Small-pox	—	—	—	—	—	1·9	—	—	—	—	—	—	·1
Enteric fever	11·1	5·6	3·3	28·0	41·1	35·2	41·0	34·9	6·7	29·2	30·9	9·4	29·7
Intermittent fever	—	—	3·3	1·3	—	1·9	—	·9	—	4·2	—	—	1·1
Remittent fever	—	—	—	—	·7	—	—	—	—	—	—	—	·1
Simple continued fever	—	—	—	—	—	—	—	—	—	—	—	—	—
Heat-stroke	—	5·6	6·7	12·0	9·9	16·7	10·3	2·8	20·0	4·2	1·1	—	7·7
Circulatory diseases	—	—	—	9·3	5·7	5·6	5·1	1·9	6·7	8·3	7·4	3·1	5·6
Tubercle of the lungs	—	—	6·7	5·3	1·4	1·9	3·8	2·8	—	—	1·1	3·1	2·8
Pneumonia	11·1	16·7	10·0	1·3	6·4	5·6	2·6	5·7	6·7	4·2	12·8	6·3	6·3
Other respiratory diseases	—	—	3·3	—	·7	—	—	—	—	—	1·1	3·1	·6
Dysentery	44·4	—	10·0	2·7	1·4	—	2·6	9·4	—	—	7·4	6·3	4·6
Diarrhœa	—	—	—	—	—	—	—	—	—	—	—	—	—
Hepatic abscess	—	—	16·7	14·7	4·3	5·6	14·1	17·0	13·3	16·7	9·6	28·1	11·7

* Worked on the aggregates.

EUROPEAN TROOPS.

TABLE IV.—STRENGTH, ADMISSIONS FROM ALL CAUSES AND ADMISSIONS FROM ENTERIC FEVER, WITH RATIOS PER 1,000, IN 1905, IN RELATION TO AGE AND LENGTH OF RESIDENCE IN INDIA.

	BY AGE.						BY LENGTH OF RESIDENCE.						
	Under 20.	20 and less than 25.	25 and less than 30.	30 and less than 35.	35 and less than 40.	40 and upwards.	Under 1 year.	1 and less than 2.	2 and less than 3.	3 and less than 4.	4 and less than 5.	5 and less than 10.	10 years and upwards.
Strength	2,446	34,243	23,079	7,576	1,967	397	17,287	12,887	15,452	7,614	5,570	8,284	2,914
Per cent. of total ..	3	49	33	11	3	1	25	18	22	11	8	12	4
1900-1904	3	44	39	11	3	1	15	15	15	14	13	23	5
Admissions from all causes.	1,383	33,449	18,322	4,829	959	210	12,207	10,545	12,225	8,482	4,353	8,779	2,561
Admissions from Enteric Fever.	33	800	255	48	7	3	470	267	205	101	26	65	12
All causes per 1,000 ..	565·4	976·8	793·9	613·1	487·5	529·0	706·1	818·3	791·2	1,114·0	781·5	1,059·8	878·9
Enteric Fever per 1,000	13·5	23·4	11·0	6·1	3·6	7·6	27·2	20·7	13·3	13·3	4·7	7·8	4·1
Enteric Fever per cent. of all causes.	2·39	2·39	1·39	·99	·73	1·43	3·85	2·53	1·68	1·19	·60	·74	·47

TABLE V.—ADMISSION AND DEATH RATES IN STATIONS OF OVER 1,000 STRENGTH.

Stations.	1905.		DECENNIUM, 1894-1903.		Stations.	1905.		DECENNIUM, 1894-1903.	
	Admission-rate per 1,000.	Death-rate per 1,000.	Admission-rate per 1 000.	Death-rate per 1,000.		Admission-rate per 1,000.	Death-rate per 1,000.	Admission rate per 1,000.	Death-rate per 1,000.
Meerut	57·3	11·68	35·3	10·87	Agra	16·6	5·24	44·1	11·70
Poona	43·2	4·69	18·7	5·38	Karachi	13·7	1·62	5·3	1·44
Peshawar	42·7	7·82	33·9	14·10	Bareilly	10·4	1·74	22·8	4·17
Lucknow	27·8	4·69	37·9	9·88	Belgaum	9·9	·90	5·3	1·76
Secunderabad ...	27·3	4·65	22·1	5·15	Chakrata	8·7	·97	31·3	4·37
Jhansi	26·8	6·69	31·3	9·27	Sialkot	7·5	1·66	15·2	5·06
Rawalpindi ...	23·9	3·42	24·0	5·80	Ambala	5·2	2·16	37·3	9·50
Mhow	23·0	7·09	38·7	8·40	Fort William ...	3·8	—	4·6	1·19
Quetta	20·5	6·56	33·8	8·08	Ranikhet	3·7	·92	31·2	4·88
Bangalore	17·3	2·27	21·5	4·58	Colaba	1·6	·79	3·8	1·93
Ahmednagar ...	16·9	2·82	36·4	7·97	Rangoon	·9	·89	9·1	2·39

TABLE VI.—ARRIVALS, AGE AND LENGTH OF RESIDENCE, IN RELATION TO VENEREAL DISEASES AND ENTERIC FEVER.

YEAR.	ARRIVED IN INDIA.*		YEAR.	MEN.							
				PER CENT OF STRENGTH.		Strength.	RATIO PER 1,000.			RATIO PER CENT. OF TOTAL ADMISSION.	
				Age.	Length of Residence.		Admissions.				
	Men.	Women.		Under 25 years	Under 5 years.		All Causes.	Venereal Diseases.	Enteric Fever.	Venereal Diseases.	Enteric Fever.
1886-87	11,645	372	1886	52	75	61,015	1,513·9	389·5	18·1	25·73	1·20
1887-88	11,729	459	1887	52	73	63,515	1,369·7	361·2	12·7	26·37	·93
1888-89	12,407	506	1888	50	76	68,887	1,381·7	370·6	13·6	26·82	·99
1889-90	12,270	532	1889	49	78	69,266	1,498·0	481·5	22·9	32·14	1·53
1890-91	14,046	542	1890	50	80	67,823	1,520·2	503·5	18·5	33·12	1·22
1891-92	15,456	529	1891	51	79	67,030	1,379·1	400·7	20·4	29·06	1·48
1892-93	15,894	540	1892	51	80	68,137	1,517·3	409·9	22·1	27·01	1·46
1893-94	15,090	482	1893	53	79	70,091	1,414·9	466·0	20·0	32·94	1·41
1894-95	15,957	517	1894	54	81	71,082	1,508 0	511·4	20·9	33·91	1·38
1895-96	14,346	654	1895	55	83	71,031	1,461·8	522·3	26·3	35·73	1·80
1896-97	14,805	545	1896	56	82	70,484	1,386·7	511·6	25·5	36·89	1·84
1897-98	16,227	543	1897	55	84	68,395	1,556·9	485·7	32·4	31·20	2·08
1898-99	16,911	648	1898	54	81	67,741	1,436·9	362·9	36·9	25·26	2·57
1899-1900 ...	3,369	168	1899	53	78	67,697	1,148·7	313·4	20·6	27·28	1·79
1900-01	5,958	185	1900	45	69	60,553	1,143·2	298·1	16·0	26·07	1·40
1901-02	18,594	438	1901	42	63	60,838	1,104·3	276·0	12·8	24·99	1·16
1902-03	24,840	961	1902	43	68	60,540	1,078·4	281·4	16·7	26·09	1·55
1903-04	15,126	758	1903	51	76	70,445	1,033·4	247·0	19·6	23·90	1·90
1904-05	16,366	820	1904	52	80	71,083	900·4	198·5	19·6	22·05	2·18
1905-06	15,178	804	1905	52	84	71,343	834·3	153·7	16·1	18·42	1·93

* In ordinary years the departures *plus* the deaths nearly balance the arrivals.

EUROPEAN TROOPS.

TABLE VII.—RELATION OF MORTALITY TO AGE AND LENGTH OF RESIDENCE IN INDIA.

A.—AGE.

CAUSES OF DEATH.	(a) DIED PER 1,000.						(b) LIABILITY IN PERCENTAGES.					
	Under 20.	20 and less than 25.	25 and less than 30.	30 and less than 35.	35 and less than 40.	40 and upwards.	Under 20.	20 and less than 25.	25 and less than 30.	30 and less than 35.	35 and less than 40.	40 and upwards.
Enteric Fever ..	·82	4·32	2·34	1·14	—	—	10	50	27	13	—	
Cholera	—	·15	·09	·13	·51	—	—	17	10	15	58	—
Dysentery ..	—	·50	·35	·76	1·02	—	—	19	13	29	39	—
Intermittent and Remittent Fevers	—	·18	·13	—	—	—	—	58	42	—	—	—
Alcoholism ..	—	—	·13	·51	1·02	5·04	—	—	2	8	15	75
Tubercle of the lungs.	—	·20	·22	·76	1·02	—	—	9	10	35	46	—
Nervous Diseases	·41	·32	·30	·38	·51	—	21	17	16	20	27	—
Circulatory Diseases.	—	·15	·65	1·78	2·03	5·04	—	2	7	18	21	52
Pneumonia ..	·41	·47	·61	1·14	2·03	—	9	10	13	24	44	—
Other Respiratory Diseases,	—	·03	—	·25	·51	—	—	4	—	32	65	—
Abscess of the liver	—	1·05	1·30	1·52	2·03	2·52	—	12	15	20	24	30
Urinary Diseases	—	·06	·09	·25	—	2·52	—	2	3	9	—	86
TOTAL ..	1·64	7·42	6·20	8·51	10·68	15·11	3	15	13	17	22	30
Heat-Stroke ..	·41	·50	·69	1·65	2·54	7·56	3	4	5	12	19	57
Suicide	—	·15	·52	·51	1·02	2·52	—	3	11	11	22	53
Other injuries ..	—	·38	·82	·89	·51	2·52	—	7	16	17	10	49
All Causes.. ..	3·68	9·72	9·45	13·59	16·78	35·26	4	11	11	15	19	40

B.—LENGTH OF RESIDENCE IN INDIA.

CAUSES OF DEATH.	(g) DIED PER 1,000.						(h) LIABILITY IN PERCENTAGES.					
	Under 1 year.	1 and less than 2.	2 and less than 3.	3 and less than 4.	4 and less than 5.	5 and less than 10.	10 and upwards.	Under 1 year.	1 and less than 2.	2 and less than 3.	3 and less than 4.	4 and less than 5.	5 and less than 10.	10 and upwards.
Enteric Fever ..	4·34	3·34	3·24	3·02	1·44	1·57	·34	25	19	19	17	8	9	2
Cholera	·12	·16	—	·26	—	·36	—	13	18	—	29	—	40	—
Dysentery ..	·58	·47	·26	·39	·18	·72	1·03	16	13	7	11	5	20	28
Intermittent and Remittent Fevers	—	·23	·06	·39	—	·24	—	—	25	7	42	—	26	—
Alcoholism ..	—	·08	·26	·26	—	·24	·69	—	5	17	17	—	16	45
Tubercle of the lungs.	·17	·31	·06	·26	—	·85	1·03	6	12	2	10	—	32	38
Nervous Diseases	·23	·23	·39	·66	·18	·24	·69	9	9	15	25	7	9	26
Circulatory Diseases.	·12	·31	·26	·53	·36	1·81	3·09	2	5	4	8	6	28	48
Pneumonia ..	·35	·47	·45	·66	·54	1·45	1·72	6	8	8	12	10	26	30
Other Respiratory Diseases,	·12	—	—	—	—	·24	—	33	—	—	—	—	67	—
Abscess of the liver	·58	·70	1·29	1·97	1·08	1·81	2·75	6	7	13	19	11	18	27
Urinary Diseases	—	—	·13	·26	·18	·12	·34	—	—	13	25	17	12	33
TOTAL ..	6·59	6·29	6·34	8·67	3·95	9·66	11·67	12	12	12	16	7	18	22
Heat-Stroke ..	·87	·78	·58	·39	·36	1·57	1·03	16	14	10	7	6	28	18
Suicide	·12	·16	·13	·79	·18	·85	1·37	3	4	3	22	5	24	38
Other injuries ..	·35	·62	·45	·39	—	1·33	2·06	7	12	9	7	—	26	40
All Causes.. ..	8·56	9·08	8·41	11·95	6·64	16·18	19·56	11	11	10	15	8	20	24

CAUSES OF DEATH.	(c) NUMBER OF DEATHS.						(d) COMPOSITION OF 100 DEATHS AT EACH AGE.					
	Under 20.	20 and less than 25.	25 and less than 30.	30 and less than 35.	35 and less than 40.	40 and upwards.	Under 20.	20 and less than 25.	25 and less than 30.	30 and less than 35.	35 and less than 40.	40 and upwards.
Enteric Fever ..	2	148	54	9	—	—	22	44	25	8	—	—
Cholera	—	5	2	1	1	—	—	2	1	1	3	—
Dysentery	—	17	8	6	2	—	—	5	4	6	6	—
Intermittent and Remittent Fevers	—	6	3	—	—	—	—	2	1	—	—	—
Alcoholism ..	—	—	3	4	2	2	—	—	1	4	6	14
Tubercle of the lungs.	—	7	5	6	2	—	—	2	2	6	6	—
Nervous Diseases	1	11	7	3	1	—	11	3	3	3	3	—
Circulatory Diseases.	—	5	15	14	4	2	—	2	7	13	12	14
Pneumonia ..	1	16	14	9	4	—	11	5	6	8	12	—
Other Respiratory Diseases.	—	1	—	2	1	—	—	—	—	2	3	—
Abscess of the liver	—	36	30	12	4	1	—	11	14	11	12	7
Urinary Diseases	—	2	2	2	—	1	—	1	1	2	—	7
TOTAL ..	4	254	143	68	21	6	44	76	66	64	63	43
Heat-stroke ..	1	17	16	13	5	3	11	5	7	12	15	21
Suicide	—	5	12	4	2	1	—	2	6	4	6	7
Other injuries ..	—	13	19	7	1	1	—	4	9	7	3	7
All Causes.. ..	9	333	218	107	33	14	100	100	100	100	100	100

CAUSES OF DEATH.	(i) NUMBER OF DEATHS.							(j) COMPOSITION OF 100 DEATHS IN EACH PERIOD OF RESIDENCE.						
	Under 1 year.	1 and less than 2.	2 and less than 3.	3 and less than 4.	4 and less than 5.	5 and less than 10.	10 and upwards.	Under 1 year.	1 and less than 2.	2 and less than 3.	3 and less than 4.	4 and less than 5.	5 and less than 10.	10 and upwards.
Enteric Fever ..	75	43	50	23	8	13	1	51	37	38	25	22	10	2
Cholera	2	2	—	2	—	3	—	1	2	—	2	—	2	—
Dysentery	10	6	4	3	1	6	3	7	5	3	3	3	4	5
Intermittent and Remittent Fevers	—	3	1	3	—	2	—	—	3	1	3	—	1	—
Alcoholism ..	—	1	4	2	—	2	2	—	1	3	2	—	1	4
Tubercle of the lungs.	3	4	1	2	—	7	3	2	3	1	2	—	5	5
Nervous Diseases	4	3	6	5	1	2	2	3	3	5	5	3	1	4
Circulatory Diseases.	2	4	4	4	2	15	9	1	3	3	4	5	11	16
Pneumonia ..	6	6	7	5	3	12	5	4	5	5	5	8	9	9
Other Respiratory Diseases.	2	—	—	—	—	2	—	1	—	—	—	—	1	—
Abscess of the liver	10	9	20	15	6	15	8	7	8	15	16	16	11	14
Urinary Diseases	—	—	2	2	1	1	1	—	—	2	2	3	1	2
TOTAL ..	114	81	99	66	22	80	34	77	69	76	73	59	60	60
Heat-stroke ..	15	10	9	3	2	13	3	10	9	7	3	5	10	5
Suicide	2	2	2	6	1	7	4	1	2	2	7	3	5	7
Other injuries ..	6	8	7	3	—	11	6	4	7	5	3	—	8	11
All Causes.. ..	148	117	130	91	37	134	57	100	100	100	100	100	100	100

CAUSES OF DEATH.	(e) NUMBER OF DEATHS.						(f) PERCENTAGE AT EACH AGE TO TOTAL NUMBER.					
	Under 20.	20 and less than 25.	25 and less than 30.	30 and less than 35.	35 and less than 40.	40 and upwards.	Under 20.	20 and less than 25.	25 and less than 30.	30 and less than 35.	35 and less than 40.	40 and upwards.
Enteric Fever ..	2	148	54	9	—	—	1	69	25	4	—	—
Cholera	—	5	2	1	1	—	—	55	22	11	11	—
Abscess of the liver	—	36	30	12	4	1	—	43	36	14	5	1
Suicide	—	5	12	4	2	1	—	21	50	17	8	4
All Causes.. ..	9	333	218	107	33	14	1	47	31	15	5	2

CAUSES OF DEATH.	(k) NUMBER OF DEATHS.							(l) PERCENTAGE IN EACH PERIOD OF RESIDENCE TO TOTAL NUMBER.						
	Under 1 year.	1 and less than 2.	2 and less than 3.	3 and less than 4.	4 and less than 5.	5 and less than 10.	10 and upwards.	Under 1 year.	1 and less than 2.	2 and less than 3.	3 and less than 4.	4 and less than 5.	5 and less than 10.	10 and upwards.
Enteric Fever ..	75	43	50	23	8	13	1	35	20	23	11	4	6	1
Cholera	2	2	—	2	—	3	—	22	22	—	22	-	33	—
Abscess of the liver	10	9	20	15	6	15	8	12	11	24	18	7	18	10
Suicide	2	2	2	6	1	7	4	8	8	8	25	4	29	17
All Causes.. ..	148	117	130	91	37	134	57	21	17	18	13	5	19	8

EUROPEAN TROOPS.

TABLE VIII.—RELATION OF INVALIDING TO AGE AND LENGTH OF RESIDENCE IN INDIA.

CAUSES OF INVALIDING.	A.—AGE. (a) INVALIDED PER 1,000. Under 20.	20 and less than 25.	25 and less than 30.	30 and less than 35.	35 and less than 40.	40 and upwards.	(b) LIABILITY IN PERCENTAGES. Under 20.	20 and less than 25.	25 and less than 30.	30 and less than 35.	35 and less than 40.	40 and upwards.	B.—LENGTH OF RESIDENCE IN INDIA. (g) INVALIDED PER 1,000. Under 1.	1 and less than 2.	2 and less than 3.	3 and less than 4.	4 and less than 5.	5 and less than 10.	10 and upwards.	(h) LIABILITY IN PERCENTAGES. Under 1.	1 and less than 2.	2 and less than 3.	3 and less than 4.	4 and less than 5.	5 and less than 10.	10 and upwards.
Dysentery	41	·70	·52	—	—	—	25	43	32	—	—	—	·06	·62	·65	·79	·90	·85	—	2	16	17	20	23	22	—
Intermittent and Remittent Fevers.	1·23	1·49	2·25	1·90	2·54	—	13	16	24	20	27	—	·52	·93	·97	1·97	2·69	6·04	3·43	3	6	6	12	16	36	21
Venereal Diseases ..	—	1·11	1·60	·89	·51	—	—	27	39	22	12	—	·29	·70	1·04	1·31	1·62	3·86	·69	3	7	11	14	17	41	7
Debility	1·64	1·69	1·91	3·55	5·08	20·15	5	5	6	10	15	59	·69	1·40	1·62	3·28	1·26	3·86	11·32	3	6	7	14	5	16	48
Rheumatism ..	—	·47	·78	1·27	·51	—	—	15	26	42	17	—	·35	·16	·52	·39	·36	2·05	2·40	6	3	8	6	6	33	39
Tubercle of the lungs.	1·23	1·72	1·56	1·65	2·54	—	14	20	18	19	28	—	·93	1·63	1·75	1·84	1·44	2·41	3·43	7	12	13	14	11	18	28
Mental Diseases ..	—	·91	1·13	·76	1·02	—	—	24	30	20	27	—	·58	·93	·45	1·18	1·62	1·81	1·03	8	12	6	15	21	24	14
Epilepsy	·41	·50	·43	·76	1·53	2·52	7	8	7	12	25	41	·23	·31	·58	·39	·36	·72	3·43	4	5	10	6	6	12	57
Other Nervous Diseases.	—	·35	·56	1·02	4·58	2·52	—	4	6	11	51	28	·35	·39	·52	·13	·36	1·09	4·12	5	6	7	2	5	16	59
Eye, ear, and nose Diseases.	2·04	2·02	1·39	1·02	—	—	31	31	21	16	—	—	1·16	1·86	1·36	2·36	1·26	2·66	·69	10	16	12	21	11	23	6
Palpitation	·82	1·28	1·08	·25	1·02	2·52	12	18	16	4	15	36	·40	1·40	·97	1·58	1·44	1·45	1·37	5	16	11	18	17	17	16
Valvular Disease of the heart.	—	1·17	1·34	2·29	3·05	—	—	15	17	29	39	—	·69	1·32	1·10	·92	1·08	2·78	4·46	6	11	9	7	9	23	36
Other Circulatory Diseases.	—	·47	·30	·51	·51	—	—	26	17	28	28	—	·06	·47	·39	·53	·36	·72	1·03	2	13	11	15	10	20	29
Respiratory Diseases.	—	·23	·52	·51	—	—	—	18	41	40	—	—	·17	·31	·19	·39	·36	·97	·34	6	11	7	14	13	36	12
Congestion, Inflammation and Abscess of the liver.	—	·82	1·21	1·52	1·53	2·52	—	11	16	20	20	33	·12	·47	1·29	1·18	1·44	2·17	3·09	1	5	13	12	15	22	32
Locomotive Diseases.	—	·85	·91	·51	—	2·52	—	18	19	11	—	53	·12	·85	·58	1·18	1·26	1·81	·69	2	13	9	18	19	28	11
Injuries	·41	·99	·74	1·65	2·03	—	7	17	13	28	35	—	·17	·70	·78	1·31	1·26	2·17	3·43	2	7	8	13	13	22	35
All Causes	8·59	20·44	22·05	24·89	33·05	42·82	5	13	15	16	22	28	8·21	18·31	18·06	24·03	24·60	43·94	57·31	4	9	9	12	13	23	29

CAUSES OF INVALIDING.	(c) NUMBER INVALIDED. Under 20.	20 and less than 25.	25 and less than 30.	30 and less than 35.	35 and less than 40.	40 and upwards.	(d) COMPOSITION OF 100 INVALIDINGS AT EACH AGE. Under 20.	20 and less than 25.	25 and less than 30.	30 and less than 35.	35 and less than 40.	40 and upwards.	(i) NUMBER INVALIDED. Under 1.	1 and less than 2.	2 and less than 3.	3 and less than 4.	4 and less than 5.	5 and less than 10.	10 and upwards.	(j) COMPOSITION OF 100 INVALIDINGS IN EACH PERIOD OF RESIDENCE. Under 1.	1 and less than 2.	2 and less than 3.	3 and less than 4.	4 and less than 5.	5 and less than 10.	10 and upwards.
Dysentery	1	24	12	—	—	—	5	3	2	—	—	—	1	8	10	6	5	7	—	1	3	4	3	4	2	—
Intermittent and Remittent Fevers.	3	51	52	15	5	—	14	7	10	8	8	—	9	12	15	15	15	50	10	6	5	5	8	11	14	6
Venereal Diseases ..	—	38	37	7	1	—	—	5	7	4	2	—	5	9	16	10	9	32	2	4	4	6	5	7	9	1
Debility	4	58	44	28	10	8	19	8	9	14	15	47	12	18	25	25	7	32	33	8	8	9	14	5	9	20
Rheumatism ..	—	16	18	10	1	—	—	2	4	5	2	—	6	2	8	3	2	17	7	4	1	3	2	1	5	4
Tubercle of the lungs.	3	59	36	13	5	—	14	8	7	7	8	—	16	21	27	14	8	20	10	11	9	10	8	6	5	6
Mental Diseases ..	—	31	26	6	2	—	—	4	5	3	3	—	10	12	7	9	9	15	3	7	5	3	5	7	4	2
Epilepsy	1	17	10	6	3	1	5	2	2	3	5	6	4	4	9	3	2	6	10	3	2	3	2	1	2	6
Other Nervous Diseases.	—	12	13	8	9	1	—	2	3	4	14	6	6	5	8	1	2	9	12	4	2	3	1	1	2	7
Eye, ear, and nose Diseases.	5	69	32	8	—	—	24	10	6	4	—	—	20	24	21	18	7	22	2	14	10	8	10	5	6	1
Palpitation	2	44	25	2	2	1	10	6	5	1	3	6	7	18	15	12	8	12	4	5	8	5	7	6	3	2
Valvular Disease of the heart.	—	40	31	18	6	—	—	6	6	9	9	—	12	17	17	7	6	23	13	8	7	6	4	4	6	8
Other Circulatory Diseases.	—	16	7	4	1	—	—	2	1	2	2	—	1	6	6	4	2	6	3	1	3	2	2	1	2	2
Respiratory Diseases.	—	8	12	4	—	—	—	1	2	2	—	—	3	4	3	3	2	8	1	2	2	1	2	1	2	1
Congestion, Inflammation and Abscess of the liver.	—	28	28	12	3	1	—	4	6	6	5	6	2	6	20	9	8	18	9	1	3	7	5	6	5	5
Locomotive Diseases.	—	29	21	4	—	1	—	4	4	2	—	6	2	11	9	9	7	15	2	1	5	3	5	5	4	1
Injuries	1	34	17	13	4	—	5	5	3	7	6	—	3	9	12	10	7	18	10	2	4	4	5	5	5	6
All Causes	21	700	509	196	65	17	100	100	100	100	100	100	142	236	279	183	137	364	167	100	100	100	100	100	100	100

CAUSES OF INVALIDING.	(e) NUMBER INVALIDED. Under 20.	20 and less than 25.	25 and less than 30.	30 and less than 35.	35 and less than 40.	40 and upwards.	(f) PERCENTAGE AT EACH AGE TO TOTAL NUMBER. Under 20.	20 and less than 25.	25 and less than 30.	30 and less than 35.	35 and less than 40.	40 and upwards.	(k) NUMBER INVALIDED. Under 1.	1 and less than 2.	2 and less than 3.	3 and less than 4.	4 and less than 5.	5 and less than 10.	10 and upwards.	(l) PERCENTAGE IN EACH PERIOD OF RESIDENCE TO TOTAL NUMBER. Under 1.	1 and less than 2.	2 and less than 3.	3 and less than 4.	4 and less than 5.	5 and less than 10.	10 and upwards.
Intermittent and Remittent Fevers.	3	51	52	15	5	—	2	40	41	12	4	—	9	12	15	15	15	50	10	7	10	12	12	12	40	8
Venereal Diseases ..	—	38	37	7	1	—	—	46	45	8	1	—	5	9	16	10	9	32	2	6	11	19	12	11	39	2
Debility	4	58	44	28	10	8	3	38	29	18	7	5	12	18	25	25	7	32	33	8	12	16	16	5	21	22
All Causes	21	700	509	196	65	17	1	46	34	13	4	1	142	236	279	183	137	364	167	9	16	19	12	9	24	11

EUROPEAN TROOPS

TABLE IX.—STATISTICS OF OFFICERS.

A.—SICKNESS AND MORTALITY AMONG OFFICERS OF THE BRITISH ARMY. (FROM THE MEDICAL RETURNS OF THE ARMY.)

—	Northern Command.		Western Command.		Eastern Command.		Secunderabad Division.		Burma Division.		India.*	
STRENGTH	574		687		581		301		101		2,323	
CASES REMAINING FROM 1904.	24		16		10		10		1		61	
	Ratios.	Actuals.	Ratios.	Actuals.	Ratios.	Actuals.	Ratios.	Actuals.	Ratios.	Actuals.	Ratios.	Actuals.
CONSTANTLY SICK ...	29·1	16·72	26·9	18·49	35·1	20·38	25·8	7·77	28·2	2·85	28·8	66·81
INVALIDS	40·07	23	58·22	40	67·13	39	49·83	15	59·41	6	52·95	1·23
ADMISSIONS.												
Influenza	52·3	30	14·6	10	46·5	27	10·0	3	—	—	30·1	70
Cholera	—	—	—	—	—	—	—	—	—	—	—	—
Small-pox	1·7	1	1·5	1	—	—	—	—	—	—	·9	2
Enteric Fever	22·6	13	24·7	17	17·2	10	23·3	7	9·9	1	21·5	50
Intermittent Fever ...	83·6	48	90·2	62	82·6	48	56·5	17	138·6	14	87·0	202
Remittent Fever	3·5	2	5·8	4	—	—	3·3	1	—	—	3·0	7
Simple Continued Fever...	61·0	35	40·8	28	51·6	30	29·9	9	99·0	10	48·2	112
Tubercle of the lungs ...	1·7	1	—	—	3·4	2	—	—	—	—	1·3	3
Pneumonia	—	—	7·3	5	3·4	2	—	—	—	—	3·0	7
Other Respiratory Diseases	13·9	8	18·9	13	22·4	13	16·6	5	49·5	5	19·4	45
Dysentery	1·7	1	46·6	32	20·7	12	33·2	10	—	—	23·7	55
Diarrhœa	26·1	15	21·8	15	60·2	35	13·3	4	49·5	5	31·9	74
Hepatic Abscess	—	—	1·5	1	—	—	—	—	—	—	·4	1
„ Congestion and Inflammation.	22·6	13	14·6	10	43·0	25	6·6	2	9·9	1	22·0	51
Venereal Diseases ...	3·5	2	1·5	1	8·6	5	3·3	1	—	—	3·9	9
All Causes	695·1	399	691·4	475	764·2	444	568·1	171	851·5	86	692·2	1,608
DEATHS.												
Cholera	—	—	—	—	—	—	—	—	—	—	—	—
Small-pox	—	—	—	—	—	—	—	—	—	—	—	—
Enteric Fever	3·48	2	1·46	1	—	—	6·64	2	9·90	1	2·58	6
Intermittent Fever ..	—	—	—	—	—	—	—	—	—	—	—	—
Remittent Fever	—	—	—	—	—	—	—	—	—	—	—	—
Simple Continued Fever ...	—	—	—	—	—	—	—	—	—	—	—	—
Heat-stroke	—	—	—	—	—	—	—	—	—	—	—	—
Circulatory Diseases ...	—	—	—	—	—	—	—	—	—	—	—	—
Tubercle of the lungs ...	1·74	1	—	—	—	—	—	—	—	—	·43	1
Pneumonia	—	—	—	—	—	—	—	—	—	—	—	—
Other Respiratory Diseases	—	—	—	—	—	—	—	—	—	—	—	—
Dysentery	—	—	—	—	—	—	—	—	—	—	—	—
Diarrhœa	—	—	—	—	—	—	—	—	—	—	—	—
Hepatic Abscess	—	—	—	—	—	—	—	—	—	—	—	—
All Causes ...	10·45	6	7·28	5	8·61	5	9·97	3	9·90	1	9·04	21
DIED OUT OF HOSPITAL	—	—	4·37	3	5·16	3	—	—	9·90	1	4·4	11

* Including officers on the line of march and with the Field Force. (*Vide* table E.—Detail of Diseases.)

B.—CAUSES OF DEATH AMONG OFFICERS OF THE BRITISH AND INDIAN ARMIES (FROM NON-MEDICAL SOURCES.)

ARMIES.	Strength in India, whether on leave or not, on the 1st of July 1905.	Strength in Europe or beyond sea on 1st July 1905, whether on furlough or sick leave.	IN INDIA.															Deaths in England and other countries.	Deaths at sea.	GRAND TOTAL.	Ratio per 1,000.
			Cholera.	Small-pox.	Enteric Fever.	Intermittent Fever.	Remittent Fever.	Simple Continued Fever.	Heat-stroke.	Circulatory Diseases.	Tubercle of the lungs.	Pneumonia.	Other Respiratory Diseases.	Dysentery.	Diarrhœa.	Hepatic Abscess.	TOTAL.				
British	3,043	580	—	—	6	—	—	—	—	—	1	—	—	—	—	—	21	—	1	22	6·07
Indian	3,259	595	—	—	9	—	—	1	—	1	—	—	1	1	1	1	28	10	—	38	9·86

NATIVE TROOPS.

TABLE X.—SUMMARY, SICKNESS AND MORTALITY.

A.—COMMANDS AND DIVISIONS. 1905.	Years.	Average strength.	RATIO PER MILLE OF STRENGTH. Admissions into hospital.	Constantly sick.	DEATHS FROM Cholera.	Small-pox.	Enteric fever.	Remittent fever.	Tubercle of the lungs.	Pneumonia.	Dysentry.	Abscess of the liver.	All causes.	Mortality including absent deaths.
Northern Command ...	1904	40,293	609	23	·02	·07	·15	·84	·74	2·90	·17	·05	7·70	12·51
	1905	36,696	652	26	·03	—	·27	·76	·76	3·32	·19	—	12·92	14·00
Western Command	1904	34,894	654	26	·32	—	·11	·52	·26	2·24	·26	·03	7·97	11·72
	1905	33,932	602	23	—	—	·21	·32	·47	1·74	·18	·03	6·60	8·10
Eastern Command	1904	22,777	545	21	·31	—	·26	·53	·53	·97	·09	—	6·23	9·88
	1905	21,823	572	23	·18	—	·60	·64	·55	1·33	·18	—	6·42	8·39
1st (Peshawar) Division ...	1904	8,870	561	19	—	—	·11	·79	·23	2·25	·11	·11	5·52	8·79
	1905	9,065	526	20	—	—	·22	·66	·44	2·87	·33	—	7·17	10·92
2nd (Rawalpindi) ,, ...	1904	7,811	664	26	—	—	·51	·77	1·15	1·54	·13	·13	7·17	11·39
	1905	8,647	785	32	·12	—	·81	·81	1 27	3·12	·35	—	8·10	12·84
3rd (Lahore) ,, ...	1904	9,076	458	25	—	·11	·11	·44	1·65	2·20	·22	—	7·16	13·77
	1905	9,157	518	27	—	—	·11	·98	·76	2·51	·11	—	27·85	33·53
4th (Quetta) ,, ...	1904	7,256	769	28	—	—	·28	·96	·41	2·89	·55	—	7·72	12·40
	1905	7,679	710	26	—	—	·13	·13	·65	2·08	·26	—	5·73	9··5
5th (Mhow) ,, ...	1904	14,358	668	26	—	—	·14	·49	·21	2·16	—	—	6·83	11·14
	1905	15,737	586	22	—	—	·25	·44	·44	1·84	·19	—	6·74	9·79
6th (Poona) ,, ...	1904	9,377	608	23	·85	—	—	·43	·11	1·92	·21	·11	9·49	13·01
	1905	9,668	500	20	—	—	·21	·21	·31	1·24	—	·10	6·00	9·52
7th (Meerut) ,, ...	1904	9,447	507	22	·64	—	·42	·64	·95	·95	·11	—	7·94	11·86
	1905	10,212	501	24	—	—	1·18	·98	·69	1·47	·20	—	7·25	9·20
8th (Lucknow) ,, ...	1904	11,498	598	24	·09	—	·17	·52	·26	1·04	·09	—	5·31	9·13
	1905	11,611	633	22	·34	—	·09	·34	·43	1·21	·17	—	5·68	9·73
9th (Secunderabad) ,, ...	1904	14,290	437	19	·07	—	—	·28	—	1·26	·21	—	6·79	8·05
	1905	11,794	466	19	·17	·08	·34	...	·08	1·27	·17	—	5·77	6·29
Burma ,, ...	1904	6,401	564	23	—	—	—	·78	·62	·78	·16	·16	6·89	10·47
	1905	4,793	614	26	—	—	—	·63	·83	·63	—	—	6·47	9·81
Kohat, Derajat and Bannu Brigades.	1904	9,800	891	29	·10	·20	—	1·73	·41	6·02	·81	—	12·65	20·31
	1905	8,693	797	30	—	—	—	·69	·69	4·83	—	—	9·20	3·80
Aden Brigade	1904	959	1,341	90	2·09	—	—	—	1·04	5·21	3·13	—	25·03	27·11
	1905	848	1,096	65	—	—	—	1·18	1·18	2·36	1·18	—	18·87	18·87
India	1904	124,055	603	24	·18	·02	·13	·71	·51	2·32	·27	·04	8·46	12·08
	1905	123,434	607	23	·06	·01	·28	·56	·50	1·90	·18	·01	8·09	9·50

B.—GEOGRAPHICAL GROUPS.	Years.	Average strengths.*	RATIO PER MILLE OF STRENGTH. Admissions.	Constantly sick.	ADMISSIONS FROM Influenza.	Cholera.	Small-pox.	Enteric fever.	Intermittent fever.	Remittent fever.	Simple continued fever.	Pneumonia.	Dysentry.	Venereal diseases.
Group I.—Burma Coast and Bay Islands.	1891–1900	1,891	794	37	2·7	·1	·2	—	195·2	6·6	4·3	5·0	66·4	55·5
	1904	1,334	711	22	11·2	—	—	—	239·9	2·2	18·7	1·5	60·0	25·5
	1905	1,195	625	24	4·2	—	—	—	168·2	5·0	52·7	2·5	52·7	10·9
,, II.—Burma Inland...	1891–1900	6,083	1,165	50	2·9	1·7	·1	·1	576·6	10·2	7·2	4·7	71·5	47·8
	1904	3,800	555	23	—	·3	—	—	190·5	5·0	·5	3·4	31·1	17·6
	1905	2,916	539	22	—	—	—	—	159·5	8 6	4·5	1·7	23·7	12·2
III.—Assam	1891–1900	2,003	1,209	51	9·2	3·0	·4	3·8	512·1	16·5	6·6	9·4	100·0	71·2
	1904	799	687	32	—	—	—	2·5	235·3	20·5	—	13·8	65·1	45·1
	1905	949	751	26	—	—	—	—	213·9	2·1	—	5·3	40·0	26·3
,, IV.—Bengal and Orissa	1891–1900	2,935	1,120	44	4·7	·4	·3	·2	511·2	15·0	6·7	5·9	86·1	35·6
	1904	2,472	788	25	29·1	·4	—	·8	325·2	4·4	—	6·0	60·7	21·8
	1905	2,558	877	27	11·3	—	—	—	353·8	24·6	21·1	10·9	95·4	19·5
,, V.—Gangetic Plain and Chutia Nagpur.	1891–1900	6,463	668	28	7·8	1·6	·5	·3	215·4	12·5	2·8	7·6	42·3	33·7
	1904	6,956	526	21	—	—	·1	·3	149·8	6·0	11·2	3·7	30·3	23·1
	1905	7,046	506	18	1·1	·6	—	·3	119·8	9·2	13·1	5·3	35·1	13 9
,, VI.—Upper Sub-Himalaya.	1891–1900	15,166	732	29	2·9	1·0	·6	·2	280·8	17·9	3·1	15·0	29·8	33·7
	1904	15,661	509	20	1·3	—	1·1	·9	160·6	4·4	·5	10·5	24·6	16·3
	1905	16,649	512	23	2·6	—	·4	2·9	111·4	8·8	5·3	15·4	24·3	19·6
,, VII.—North-Western Frontier, Indus Valley, and North-Western Rajputana.	1891–1900	15,459	1,102	36	8·9	2·3	·6	·2	507·5	22·2	10·3	29·4	56·5	22·5
	1904	18,157	736	26	·5	·1	·4	·7	254·4	13·3	1·0	19·1	42·8	13·5
	1905	17,946	664	25	4·0	—	·7	·7	170·8	9·9	7·0	20·5	39·5	14·7
,, VIII.—South-Eastern Rajputana, Central India and Gujarat.	1891–1900	12,679	814	27	6·0	1·6	·7	·1	337·5	11·3	12·3	13·1	29·9	41·5
	1904	12,529	678	26	—	—	·2	·1	218·5	2·5	5·3	14·8	16·5	19·5
	1905	13,651	588	21	1·0	·2	1·4	·7	211·8	3·4	6·8	14·7	18·1	18·0
,, IX.—Deccan	1891–1900	19,504	736	27	7·0	1·9	1·3	·1	292·6	11·2	11·6	9·3	31·3	43·0
	1904	16,162	503	19	—	·7	·5	·2	110·4	4·0	11·6	7·1	26·0	27·2
	1905	15,977	445	18	·2	—	1·3	1·1	73·2	2·4	20·7	6·6	25·0	24·3
,, X.—Western Coast ...	1891–1900	3,055	714	29	2·2	·3	·5	·4	159·9	14·9	26·8	6·7	60·5	53·3
	1904	1,950	674	31	—	—	4·6	—	209·2	5·1	11·8	9·8	29·2	53·3
	1905	1,978	606	29	—	—	4·0	·5	192·6	1·5	10·6	13·7	20·7	38·4
,, XI.—Southern India	1891–1900	8,244	565	29	3·5	2·5	·6	·1	132·0	3·6	21·7	7·9	20·1	43·2
	1904	6,786	537	25	4·4	·3	·1	—	102·0	·9	9·4	7·1	21·7	36·3
	1905	5,967	552	21	·5	·5	·2	·2	122·2	·8	57·3	5·0	19·9	30·5
,, XII.—Hill Stations ...	1891–1900	17,027	1,075	40	21·3	1·0	·3	·6	470·0	24·6	8·4	20·5	53·3	49·6
	1904	20,366	657	28	2·5	·3	·3	·9	225·4	11·1	12·4	15·6	26·3	21·2
	1905	20,224	729	31	·3	·0	·0	1·6	170·3	11·5	23·4	13·7	32·3	24·3
India	1891–1900	127,666	852	32	8·1	1·8	·5	·3	348·8	15·2	9·1	14·4	48·8	37·2
	1904	124,055	603	24	1·8	·2	·5	·6	194·1	7·2	6·7	11·7	31·5	20·6
	1905	123,434	607	23	1·5	·1	·6	1·1	171·2	8·4	14·3	12·5	32·5	19·6

* The decennial ratios are worked on the total strength of the ten year period.

NATIVE TROOPS.

TABLE XI.—RATIOS OF COMMANDS.

	Ratio per 1,000 of the Average Strength.					
	Northern Command.	Western Command.	Eastern Command.	Secundera-bad Division.	Burma Division.	Army of India.*
I.—AVERAGE ANNUAL STRENGTH	36,696	33,932	21,823	11,794	4,793	123,434
II.—CONSTANTLY-SICK-RATE OF EACH MONTH—						
January	30·2	27·1	22·8	21·8	29·0	23·9
February	30·6	24·9	21·6	20·2	26·7	24·3
March	23·8	21·6	18 8	18·3	20·9	21·5
April	26·3	23·7	20·2	18·6	15·2	23·7
May	25·5	21·5	23·1	19·1	18·4	24·0
June	24·9	21·2	24·2	20·7	27·9	23·8
July	23·8	20·1	24·1	21·7	35·1	23·5
August	25·3	22·4	24·0	19 4	29·4	23·5
September	23·2	23·0	24·0	17·3	24·2	22·3
October	23·8	22·3	22·4	15·9	23·9	21·1
November	31·1	24·9	23·1	17·6	28·1	23·4
December...	29·8	23·9	24·6	18·5	26·8	23·7
OF THE YEAR	26·5	23·1	22·7	19·1	25·6	23·2
III.—ADMISSION-RATE OF THE YEAR						
Influenza	2·3	1·3	2·2	·3	1·0	1·5
Cholera	·0	·1	·2	·3	—	·1
Small-pox	·5	1·5	—	·3	—	·6
Enteric Fever	1·4	·5	2·0	1·1	·2	1·1
Intermittent Fever	142·6	185·0	159·4	80·4	167·1	171·2
Remittent Fever	11·1	3·7	10·7	1·8	7·3	8·4
Simple Continued Fever	16·7	8·4	10·2	42·9	15·9	14·3
Tubercle of the lungs	5·4	2·4	2·8	1·2	3·1	3·1
Pneumonia	20·4	11·4	9·0	5·5	3·1	12·5
Other Respiratory Diseases	35·4	29·6	23·1	15·4	22·7	28·5
Dysentery	34·6	24·9	36·8	25·6	37·6	32·5
Diarrhœa	6·7	7·9	10·7	2·2	5·2	7·5
Hepatic { Abscess	·1	·1	·1	—	—	·2
Hepatic { Congestion and Inflammation ...	·5	·8	·7	·4	·8	·6
Scurvy	1·0	4·0	·6	·8	·4	1·7
Venereal Diseases	18·8	20·5	19·5	27·0	20·9	19·6
ALL CAUSES	651·8	602·4	571·5	466·1	614·2	607·1
IV.—DEATH-RATE OF THE YEAR—						
Cholera	·03	—	·18	·17	—	·06
Small-pox	—	—	—	·08	—	·01
Enteric Fever	·27	·21	·60	·34	—	·28
Intermittent Fever	·19	·41	·37	·34	·63	·37
Remittent Fever	·76	·32	·64	—	·63	·56
Simple Continued Fever	—	—	—	—	—	—
Circulatory Diseases	·16	·32	·18	·59	—	·26
Tubercle of the lungs	·76	·47	·55	·08	·83	·50
Pneumonia	3·32	1·74	1·33	1·27	·63	1·90
Other Respiratory Diseases	·27	·21	·32	·08	·21	·23
Dysentery	·19	·18	·18	·17	—	·18
Diarrhœa	·05	·09	·05	—	—	·06
Hepatic Abscess	—	·03	—	—	—	·01
Anæmia and Debility	—	·18	·05	—	·42	·09
ALL CAUSES	12·92	6·60	6·42	5·77	6·47	8·09
V.—PERCENTAGE IN 100 ADMISSIONS—						
Influenza	·36	·22	·38	·05	·17	·25
Cholera	·00	·01	·03	·05	—	·01
Small-pox	·08	·24	—	·05	—	·10
Enteric Fever	·22	·09	·35	·24	·03	·17
Intermittent Fever	21·88	30·70	27·89	17·25	27·21	28·21
Remittent Fever	1·70	·61	1·88	·38	1·19	1·38
Simple Continued Fever	2·56	1·39	1·78	9·21	2·58	2·36
Tubercle of the lungs	·82	·40	·50	·25	·51	·51
Pneumonia	3·13	1·89	1·58	1·18	·51	2·07
Other Respiratory Diseases	5·43	4·92	4·05	3·31	3·70	4·70
Dysentery	5·31	4·14	6·43	5·49	6·11	5·36
Diarrhœa	1·03	1·31	1·87	·47	·85	1·24
Hepatic { Abscess	·02	·02	·02	—	—	·03
Hepatic { Congestion and Inflammation ...	·07	·13	·13	·09	·14	·10
Scurvy	·16	·67	·10	·16	·07	·28
Venereal Diseases	2·88	3·40	3·41	5·80	3·40	3·23
VI.—PERCENTAGE IN 100 DEATHS—						
Cholera	·2	—	2·9	2·9	—	·7
Small-pox	—	—	—	1·5	—	·1
Enteric Fever	2·1	3·1	9·3	5·9	—	3·5
Intermittent Fever	1·5	6·3	5·7	5·9	9·7	4·6
Remittent Fever	5·9	4·9	10·0	—	9·7	6·9
Simple Continued Fever	—	—	—	—	—	—
Circulatory Diseases	1·3	4·9	2·9	10·3	—	3·2
Tubercle of the lungs	5·9	7·1	8·6	1·5	12·9	6·2
Pneumonia	25·7	26·3	20·7	22·1	9·7	23·5
Other Respiratory Diseases	2·1	3·1	5·0	1·5	3·2	2·8
Dysentery	1·5	2·7	2·9	2·9	—	2·2
Diarrhœa	·4	1·3	·7	—	—	·7
Hepatic Abscess	—	·4	—	—	—	·1
Anæmia and Debility	—	2·7	·7	—	6·5	1·1

* Excluding troops in China and Somaliland only.

Native Troops.

Table XII.—Ratios of Geographical Groups.

	Ratio per 1,000 of the Average Strength.												
	I. Burma, Coast and Bay Islands.	II. Burma Inland.	III. Assam.	IV. Bengal and Orissa.	V. Gangetic Plain and Chutia Nagpur.	VI. Upper Sub-Himalaya.	VII. North-Western Frontier, Indus Valley, and North-Western Rajputana.	VIII. South-Eastern Rajputana, Central India and Gujarat.	IX. Deccan.	X. Western Coast.	XI. Southern India.	XII. Hill Stations.	Army of India.
I—Average Annual Strength	1,195	2,916	949	2,558	7,046	16,649	17,946	13,651	15,977	1,978	5,967	20,224	123,434
II.—Constantly-sick-rate of each Month—													
January	23·7	31·0	29·6	31·1	15·2	20·7	34·7	24·8	19·1	39·6	23·3	31·4	23·9
February	17·5	28·4	30·2	27·5	14·5	21·3	32·9	21·7	19·2	40·2	22·2	32·4	24·3
March	17·6	18·5	22·3	21·4	13·4	19·3	24·7	16·7	16·6	31·3	21·0	27·7	21·5
April	9·7	12·6	10·9	20·9	15·4	23·4	18·1	20·1	17·7	33·5	20·7	34·1	23·7
May	17·8	12·6	25·5	22·1	17·6	25·3	18·3	17·8	17·0	34·7	20·7	31·8	24·0
June	41·8	20·3	30·8	23·3	17·6	22·5	19·9	16·3	17·0	24·6	24·6	32·8	23·8
July	50·3	26·8	34·0	28·0	18·7	22·2	20·4	16·4	18·3	22·8	24·2	29·1	23·5
August	35·2	23·1	25·3	33·1	19·1	23·4	20·6	18·9	18·8	27·8	20·1	31·6	23·5
September	27·1	19·0	19·6	31·0	22·5	20·5	19·8	22·8	17·2	23·9	18·7	30·6	22·3
October	20·7	20·7	18·7	27·5	21·1	21·5	23·8	23·9	16·8	25·4	16·4	26·0	21·1
November	16·8	26·5	28·8	30·5	19·8	27·3	32·3	27·6	19·9	23·2	19·4	30·4	23·4
December	20·3	22·7	32·3	22·8	20·9	27·2	37·6	26·4	18·6	22·1	20·5	32·1	23·7
Of the Year	24·1	22·1	25·7	26·7	17·8	22·8	25·3	21·4	18·1	29·1	21·2	30·8	23·2
III.—Admission-rate of the Year:—													
Influenza	4·2	—	—	11·3	1·1	2·6	4·0	1·0	·2	—	·5	·3	1·5
Cholera	—	—	—	—	·6	—	—	·2	—	—	·5	·0	·1
Small-pox	—	—	—	—	—	·4	·7	1·4	1·3	4·0	·2	·0	·6
Enteric Fever	—	—	—	—	·3	2·9	·7	·7	1·1	·5	·2	1·6	1·1
Intermittent Fever	168·2	159·5	213·9	353·8	119·8	111·4	170·8	211·8	73·2	192·6	122·2	170·3	171·2
Remittent Fever	5·0	8·6	2·1	24·6	9·2	8·8	9·9	3·4	2·4	1·5	·8	11·5	8·4
Simple Continued Fever	52·7	4·5	—	21·1	13·1	5·3	7·0	6·8	20·7	10·6	57·3	23·4	14·3
Tubercle of the lungs	2·5	2·7	1·1	2·7	3·4	4·7	4·5	3·2	·6	3·5	1·7	4·6	3·1
Pneumonia	2·5	1·7	5·3	10·9	5·3	15·4	20·5	14·7	6·6	13·7	5·0	13·7	12·5
Other Respiratory Diseases	21·8	23·3	37·9	28·1	21·7	27·4	29·0	24·2	19·9	19·2	15·8	45·5	28·5
Dysentery	52·7	23·7	40·0	95·4	35·1	24·3	39·5	18·1	25·0	20·7	19·9	32·3	32·5
Diarrhœa	4·2	6·2	23·2	43·0	3·0	5·6	7·0	4·2	5·1	13·1	2·8	9·7	7·5
Hepatic: Abscess	—	—	—	—	·1	·1	·1	—	·3	—	—	·2	·2
Hepatic: Congestion and Inflammation	·8	·3	1·1	·4	·9	·7	·2	·9	·9	—	·5	·7	·6
Scurvy	—	·7	1·1	1·2	·6	·8	1·1	1·5	1·1	7·1	·2	4·2	1·7
Venereal Diseases	10·9	12·3	26·3	19·5	13·9	19·6	14·7	18·0	24·3	38·4	30·5	24·3	19·6
All Causes	625·1	539·4	751·3	877·2	505·5	512·2	664·0	588·2	444·6	606·2	551·7	729·3	607·1
IV.—Death-rate of the Year—													
Cholera	—	—	—	—	·57	—	—	—	—	—	·34	·05	·06
Small-pox	—	—	—	—	—	—	—	—	—	—	·17	—	·01
Enteric Fever	—	—	—	—	·14	·78	·06	·29	·31	·51	—	·45	·28
Intermittent Fever	—	·34	—	·78	·28	—	·28	·51	·19	·51	·50	·45	·37
Remittent Fever	·84	·69	1·05	·78	·14	·78	·50	·44	·13	·51	—	·84	·56
Simple Continued Fever	—	—	—	—	—	—	—	—	—	—	—	—	—
Circulatory Diseases	—	—	—	—	·28	·06	·17	·22	·25	2·53	·50	·30	·26
Tubercle of the lungs	—	·34	—	—	·57	·36	·67	·51	·13	1·01	—	1·29	·50
Pneumonia	·84	·69	1·05	1·17	·99	2·76	3·29	1·98	·94	3·54	1·01	2·37	1·90
Other Respiratory Diseases	—	·34	—	—	·43	·18	·28	·37	·06	·51	—	·35	·23
Dysentery	—	—	—	·39	·14	·12	·06	·22	—	—	·34	·40	·18
Diarrhœa	—	—	1·05	—	—	·06	—	·07	—	1·01	—	·05	·06
Hepatic Abscess	—	—	—	—	—	—	—	—	·06	—	—	—	·01
Anæmia and Debility	·84	·34	—	·39	—	—	—	·15	·13	1·01	—	—	·09
All Causes	4·18	5·14	4·21	5·08	5·96	6·97	7·02	6·89	4·19	17·69	5·87	18·05	8·09
V.—Percentage in 100 Admissions—													
Influenza	·67	—	—	1·29	·22	·52	·60	·17	·04	—	·09	·05	·25
Cholera	—	—	—	—	·11	—	—	·04	—	—	·09	·01	·01
Small-pox	—	—	—	—	—	·08	·11	·24	·30	·67	·03	·01	·10
Enteric Fever	—	—	—	—	·06	·57	·11	·12	·25	·08	·03	·22	·17
Intermittent Fever	26·91	29·56	28·47	40·33	23·69	21·75	25·72	36·00	16·47	31·78	22·14	23·35	28·21
Remittent Fever	·80	1·59	·28	2·81	1·82	1·72	1·49	·57	·53	·25	·15	1·58	1·38
Simple Continued Fever	8·43	·83	—	2·41	2·58	1·03	1·06	1·16	4·65	1·75	10·39	3·21	2·36
Tubercle of the lungs	·40	·51	·14	·31	·67	·93	·68	·55	·13	·58	·30	·63	·51
Pneumonia	·40	·32	·70	1·25	1·04	3·00	3·09	2·49	1·48	2·25	·91	1·88	2·07
Other Respiratory Diseases	3·48	4·32	5·05	3·21	4·30	5·36	4·36	4·12	4·48	3·17	2·86	6·24	4·70
Dysentery	8·43	4·39	5·33	10·87	6·93	4·74	5·94	3·08	5·63	3·42	3·61	4·43	5·36
Diarrhœa	·67	1·14	3·09	4·90	·59	1·10	1·05	·72	1·14	2·17	·52	1·33	1·24
Hepatic: Abscess	—	—	—	—	·03	·01	·01	—	·06	—	—	·03	·03
Hepatic: Congestion and Inflammation	·13	·06	·14	·04	·17	·13	·03	·15	·20	—	·09	·10	·10
Scurvy	—	·13	·14	·13	·11	·16	·17	·26	·24	1·17	·03	·57	·28
Venereal Diseases	1·74	2·29	3·51	2·23	2·75	3·83	2·22	3·06	5·48	6·34	5·53	3·33	3·23
VI.—Percentage in 100 Deaths—													
Cholera	—	—	—	—	9·5	—	—	—	—	—	5·7	·3	·7
Small-pox	—	—	—	—	—	—	—	—	—	—	2·9	—	·1
Enteric Fever	—	—	—	—	2·4	11·2	·8	4·3	7·5	2·9	—	2·5	3·5
Intermittent Fever	—	6·7	—	15·4	4·8	—	4·0	7·4	4·5	2·9	8·6	2·5	4·6
Remittent Fever	20·0	13·3	25·0	15·4	2·4	11·2	7·1	6·4	3·0	2·9	—	4·5	6·9
Simple Continued Fever	—	—	—	—	—	—	—	—	—	—	—	—	—
Circulatory Diseases	—	—	—	—	4·8	·9	2·4	3·2	6·0	14·3	8·6	1·6	3·2
Tubercle of the lungs	—	6·7	—	—	9·5	5·2	9·5	7·4	3·0	5·7	—	7·1	6·2
Pneumonia	20·0	13·3	25·0	23·1	16·7	39·7	46·8	28·7	22·4	20·0	17·1	13·2	23·5
Other Respiratory Diseases	—	6·7	—	—	7·1	2·6	4·0	5·3	1·5	2·9	—	1·9	2·8
Dysentery	—	—	—	7·7	2·4	1·7	·8	3·2	—	—	5·7	2·2	2·2
Diarrhœa	—	—	25·0	—	—	·9	—	1·1	—	5·7	—	·3	·7
Hepatic Abscess	—	—	—	—	—	—	—	—	1·5	—	—	—	·1
Anæmia and Debility	20·0	6·7	—	7·7	—	—	—	2·1	3·0	5·7	—	—	1·1

NATIVE TROOPS.

TABLE XIII.—SICKNESS AND MORTALITY IN PLAINS AND HILLS.—(1. ACTUALS; 2. RATIOS).

	C. PLAINS AND HILLS.	Average annual strength.	Intermittent Fever.		Remittent Fever.		Tubercle of the lungs.		Pneumonia.		Other respiratory diseases.		Dysentery and Diarrhœa.		Scurvy.		Anæmia and Debility.		All Causes.		Average number constantly sick.
			A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D	
1901.	Plains	98,569	34,331	98	1,044	89	355	57	1,156	229	3,038	45	4,895	46	255	4	1,460	9	78,956	957	2,841
			348·3	·99	10·6	·89	3·6	·58	12·7	2·32	30·8	·46	50·0	·47	2·6	·04	14·8	0·9	801·0	9·71	28·8
	Hills	20,936	8,192	14	694	61	155	46	390	101	897	11	1,248	10	136	4	394	7	19,786	318	72·4
			391·3	·67	33·1	2·91	7·4	2·20	18·6	4·82	42·8	·53	59·6	·47	6·5	·19	18·8	·33	945·1	15·19	34·6
	Hills above 5,000 feet sea-level.	9,906	2,359	6	104	11	53	16	137	23	240	1	328	3	23	..	129	2	6,572	81	270
			261·9	·67	11·5	1·22	5·9	1·78	15·2	2·55	26·6	·11	36·4	·33	2·6	..	14·3	·22	729·7	8·99	30·0
	Hills below 5,000 feet sea-level.	11,930	5,833	8	590	50	102	30	253	78	657	10	920	7	113	4	265	5	13,214	237	454
			483·9	·67	49·5	4·19	8·5	2·51	21·2	6·54	55·1	·84	77·1	·59	9·5	·34	22·2	·42	1,107·6	19·87	38·2
1902.	Plains	99,841	26,587	90	1,091	119	333	53	1,456	351	2,401	30	5,150	57	220	2	1,272	14	69,816	1,079	2,523
			266·3	1·90	10·9	1·19	3·3	·53	14·6	3·52	24·0	·30	51·6	·57	2·2	·02	12·7	·14	699·3	10·81	25·3
	Hills	20,950	6,887	18	388	23	196	46	429	1·07	576	12	1,485	12	82	..	461	7	17,218	287	681
			328·7	·86	18·5	1·10	9·4	2·20	20·5	5·11	27·5	·57	70·9	·57	3·9	..	22·0	·33	821·9	13·70	32·5
	Hills above 5,000 feet sea-level.	8,553	1,445	7	167	14	50	16	125	18	191	4	430	7	27	..	110	2	5,183	91	240
			165·4	·82	19·5	1·64	5·8	1·87	14·6	2·10	22·3	·47	50·3	·82	3·2	..	12·9	·23	606·0	10·64	28·1
	Hills below 5,000 feet sea-level.	12,397	5,472	11	221	9	146	30	304	89	385	8	1,055	5	55	..	351	5	12,035	196	441
			441·4	·89	17·8	·73	11·8	2·42	24·5	7·18	31·1	·65	85·1	·40	4·4	..	28·3	·40	970·8	15·86	35·6
1903.	Plains	100,869	24,204	60	854	94	369	46	1,340	277	2,122	22	4,225	38	179	8	1,424	8	64,660	944	2,349
			240·0	·59	8·5	·93	3·7	·46	13·3	2·75	21·0	·22	41·9	·38	1·8	·08	10·1	·08	641·0	9·36	23·3
	Hills	21,676	5,898	16	219	16	350	35	448	202	611	4	1,156	11	120	11	328	5	16·466	238	733
			272·1	·74	10·1	·74	16·1	1·61	20·7	4·71	28·2	·18	53·3	·51	5·5	·51	15·1	·23	759·6	13·06	33·8
	Hills above 5,000 feet sea-level.	9,900	1,455	4	105	3	50	18	137	16	213	1	357	4	20	..	99	1	5,673	82	255
			147·0	·40	10·6	·30	5·1	1·82	13·8	1·62	21·5	·10	36·1	·40	2·0	..	10·0	·10	573·0	8·28	25·8
	Hills above 5,000 feet sea-level.	11,776	4,443	12	114	13	300	17	311	86	398	3	799	7	100	11	229	4	10,793	201	478
			377·3	1·02	9·7	1·10	25·5	1·44	26·4	7·30	33·8	·25	67·8	·59	8·5	·93	19·4	·34	916·5	17·07	40·6
1904.	Plains	98,289	17,182	32	605	53	340	25	1,048	190	1,924	23	3,476	20	324	1	1,283	12	56,276	692	2,151
			174·8	·33	6·2	·54	3·5	·25	10·7	1·93	19·6	·23	35·4	·20	3·3	·01	13·1	·12	572·6	7·04	21·9
	Hills	20,366	4,590	10	226	20	125	30	318	50	426	4	702	8	83	1	252	..	13,377	180	576
			225·4	·49	11·1	·98	6·1	1·47	15.6	2·46	20·9	·20	34·5	·39	4·1	·05	12·4	..	656·8	8·84	28·3
	Hills above 5,000 feet sea-level.	8,576	1,438	7	85	7	49	12	103	13	165	3	269	1	35	1	81	..	5,055	72	227
			157·7	·82	9·9	·82	5·7	1·40	12·0	1·52	19·2	·35	31·4	·12	4·1	·12	9·4	..	589·4	8·40	26·5
	Hills below 5,000 feet sea-level.	11,790	3,152	3	141	13	76	18	215	37	261	1	433	7	48	..	171	..	8,322	108	349
			267·3	·25	9·7	12·0	6·4	1·53	18·2	3·14	22·1	·08	36·7	·59	4·1	..	14·5	..	705·9	9·16	29·6
1905.	Plains	99,771	14,461	28	669	41	287	33	1,266	185	2,528	23	3,771	18	124	3	1,080	9	55,250	602	2,083
			144·9	·28	6·7	·41	2·9	·33	12·7	1·86	25·3	·21	37·8	·18	1·2	·03	10·8	·09	553·8	6·03	520·9
	Hills	20,224	3,444	9	233	17	93	26	277	50	920	5	850	9	84	1	253	..	14,749	365	624
			170·3	·45	11·5	·84	4·6	1·29	13·7	2·37	45·5	·35	42·0	·45	4·2	·05	12·5	..	729·3	18·0	30·9
	Hills above 5,000 feet sea-level.	9,583	1,297	4	60	7	46	13	95	20	333	2	341	6	50	1	100	..	5,698	260	260
			135·3	·42	6·3	·73	4·8	1·36	9·9	2·09	34·7	·21	35·6	·63	5·2	·10	10·4	..	594·6	27·13	27·1
	Hills below 5,000 feet sea-level.	10,641	2,147	5	173	10	47	13	182	30	587	3	509	3	34	..	153	..	9,051	105	364
			201·8	·47	16·3	·94	4·4	1·22	17·1	2·63	55·2	·47	47·8	·28	3·2	..	14·4	..	850·6	9·87	34·2

PRISONERS.

TABLE XIV.—SUMMARY, SICKNESS AND MORTALITY.

A.—ADMINISTRATIONS.	Years.	Average strength.†	RATIO PER MILLE OF STRENGTH.*												
			Admissions.	Constantly sick.	Deaths from										
					Cholera.	Small-pox.	Remittent fever.	Tubercle of the lungs.	Pneumonia.	Other respiratory diseases.	Dysentery.	Diarrhœa.	Anæmia and debility.	All causes
Burma	1901-1904	11,564	487	23	·95	..	·28	3·59	1·41	·48	2·81	·78	·35	16·71
	1904	11,704	387	20	1·71	..	·26	2·99	·68	·43	2·82	1·62	·43	18·63
	1905	12,639	320	17	..	·08	·08	3·80	1·03	·63	2·61	·95	·24	17·01
Eastern Bengal and Assam	1901-1904	6,256	1,104	45	·36	·12	·68	3·32	3·72	·72	7·71	1·12	1·16	26·81
	1904	6,211	979	37	·16	..	·48	3·00	4·83	·04	4·99	·48	1·45	22·38
	1905	6,401	1,061	46	1·87	..	·47	3·44	2·50	·94	7·50	·78	2·66	32·96
Bengal	1901-1904	14,674	973	37	·87	·05	·31	3·82	2·57	·41	5·66	1·47	·58	23·70
	1904	14,069	883	35	·36	·07	·36	3·70	1·71	·14	5·33	1·63	·28	19·55
	1905	14,172	954	39	·35	..	·21	4·02	2·12	1·06	6·56	1·06	·49	24·91
United Provinces of Agra and Oudh	1901-1904	26,026	729	34	·53	·04	·07	3·04	2·43	·90	4·14	1·10	·22	19·10
	1904	23,902	612	28	..	·04	..	2·30	2·64	·96	2·34	·79	·17	14·56
	1905	23,680	569	27	·17	·04	·21	2·66	3·00	1·10	1·94	·84	·21	17·31
Punjab	1901-1904	12,538	1,065	33	·06	·10	·40	3·51	5·24	·66	3·09	·88	·68	22·91
	1904	11,740	907	31	..	..	..	3·41	5·45	·43	2·56	·85	·43	19·76
	1905	11,512	708	26	·35	·09	·09	4·43	2·52	·69	·52	·17	·69	16·33
North-West Frontier Province	1901-1904	1,281	1,030	32	..	·98	..	·78	5·08	·39	3·51	·39	·39	20·50
	1904	1,297	1,102	32	..	..	..	·77	3·86	·77	3·08	..	..	14·65
	1905	1,314	960	34	..	..	·76	1·52	1·52	·76	4·57	·76	..	19·79
Bombay	1901-1904	8,943	708	30	·06	·17	·87	3·55	7·32	1·62	1·89	1·73	·84	28·32
	1904	7,804	600	25	·26	·26	·38	3·72	4·87	1·03	1·15	1·15	·26	19·22
	1905	7,851	603	27	..	·13	·51	2·29	3·06	1·53	1·15	1·15	·76	17·45
Central Provinces	1901-1904	4,650	799	26	·05	..	·05	2·63	2·69	1·34	4·03	2·15	1·29	21·02
	1904	3,740	586	20	·27	..	..	2·94	1·34	1·07	1·34	·53	..	12·57
	1905	3,547	630	21	·28	..	..	1·97	1·41	1·13	1·41	·28	·56	15·79
Madras	1901-1904	9,753	485	22	1·36	·03	·13	3·79	2·08	·31	2·18	·10	·41	19·48
	1904	9,320	439	20	·21	..	·11	3·97	1·39	·75	2·04	·21	·43	16·52
	1905	10,147	469	19	1·38	..	·20	2·37	1·48	·39	3·06	·30	·20	15·87
INDIA‡	1901-1904	96,370	785	32	·57	·07	·30	3·36	3·26	·76	3·87	1·11	·57	21·58
	1904	90,353	676	28	·34	·04	·17	3·09	2·79	·65	2·91	·97	·41	17·61
	1905	91,917	647	28	·44	·04	·22	3·19	2·28	·92	3·01	·74	·54	19·23
ANDAMANS	1901-1904	13,025	1,822	59	..	..	2·51	7·98	4·07	1·38	10·23	1·86	·02	36·95
	1904	13,972	1,909	64	..	..	2·08	7·23	2·86	1·50	7·94	1·50	..	34·75
	1905	14,348	1,898	68	..	..	2·86	6·48	4·81	·91	13·03	·49	..	38·96
INDIA§	1901-1904	109,395	909	35	·50	·06	·56	3·91	3·36	·83	4·63	1·20	·50	23·41
	1904	104,325	841	33	·30	·04	·42	3·64	2·80	·77	3·58	1·04	·35	19·91
	1905	106,265	816	33	·38	·04	·57	3·63	2·63	·92	4·37	·71	·47	21·90

* Excluding Subsidiary Jails. † The quadrennial ratios are worked on the total strength of the four years.
‡ Including Ajmer, Quetta, Mercara and Secunderabad and excluding Andamans. § Including Andamans.

B.—GEOGRAPHICAL GROUPS.	Years.	Average strength.†	RATIO PER MILLE OF STRENGTH.*										
			Admissions	Constantly sick.	Admissions from.								
					Influenza.	Cholera.	Small-pox.	Enteric fever.	Intermittent fever.	Remittent fever	Simple continued fever.	Pneumonia.	Dysentery.
Group I.—Burma Coast and Bay Islands	1901-1904	7,758	493	23	·9	1·5	..	·5	116·0	3·4	17·6	4·0	42·9
	1904	7,901	340	17	2·8	1·0	..	..	37·7	1·4	37·7	2·7	20·9
	1905	8,808	262	14	..	..	·2	·6	32·1	·8	24·6	3·3	16·3
„ II.—Burma Inland	1901-1904	3,808	476	23	4·3	2·0	·1	·5	111·0	2·9	2·2	9·1	70·6
	1904	3,803	484	26	..	6·8	·3	..	81·0	2·4	1·8	2·6	104·1
	1905	3,831	455	22	3·7	·8	..	·8	94·5	·8	6·0	3·4	55·9
„ III.—Assam	1901-1904	1,201	806	39	23·7	1·5	1·5	·2	266·9	6·0	4·0	5·8	226·8
	1904	1,219	648	35	..	·8	..	·8	154·2	9·8	6·6	8·2	218·2
	1905	1,391	868	52	3·6	1·4	..	..	228·6	4·3	5·8	1·4	259·5
„ IV.—Bengal and Orissa	1901-1904	12,252	1,009	40	21·5	1·0	·5	·3	275·7	2·3	12·8	10·7	259·4
	1904	12,016	909	36	12·3	·1	·1	·5	252·1	1·5	·2	10·0	257·1
	1905	11,901	1,036	43	19·9	1·3	·1	1·2	248·0	1·2	2·7	9·0	256·6
„ V.—Gangetic Plain and Chutia Nagpur	1901-1904	24,087	788	34	16·8	1·0	·5	·5	273·4	1·2	3·7	10·2	85·7
	1904	21,973	708	29	·3	·2	·7	·3	272·0	1·0	6·4	7·8	84·9
	1905	22,083	686	30	12·7	·4	·2	·3	230·0	1·1	8·0	9·1	87·2
„ VI.—Upper Sub-Himalaya	1901-1904	13,381	1,008	33	17·6	·1	·3	·9	447·6	1·2	3·7	18·7	61·4
	1904	12,139	816	28	7·5	..	..	1·5	334·6	·1	3·1	16·9	50·9
	1905	11,930	669	25	18·7	·3	·3	·6	236·6	1·4	4·8	12·3	33·8
„ VII.—North-West Frontier, Indus Valley and North-Western Rajputana.	1901-1904	8,076	820	30	3·9	·3	1·9	·2	311·7	1·4	1·4	30·0	53·7
	1904	8,365	787	32	9·2	..	·1	·1	260·1	1·4	1·0	22·5	46·9
	1905	8,407	651	26	30·9	·4	1·0	..	212·0	1·1	..	17·4	28·4
„ VIII.—South-Eastern Rajputana, Central India and Gujarat.	1901-1904	4,879	806	41	15·1	·6	·7	·1	304·7	1·1	·4	20·1	41·1
	1904	4,171	626	32	..	..	·2	..	226·1	1·2	·5	21·3	25·4
	1905	4,346	524	30	..	..	·2	..	160·4	·2	..	22·3	16·1
„ IX.—Deccan	1901-1904	8,712	840	32	15·9	·1	·3	·3	309·9	7·0	4·8	10·7	50·9
	1904	7,287	618	23	·1	·4	·5	·1	161·7	·4	8·2	7·3	44·2
	1905	7,017	672	28	4·6	·1	..	..	158·0	1·0	3·4	6·1	47·2
„ X.—Western Coast	1901-1904	2,830	527	24	1·7	·2	·9	3·8	158·1	5·4	7·6	9·5	39·9
	1904	2,506	584	24	..	..	·4	8·0	183·6	2·4	9·6	8·4	34·3
	1905	2,318	532	20	..	..	1·3	3·0	141·1	1·3	11·6	9·9	42·3
„ XI.—Southern India	1901-1904	8,746	500	22	5·3	3·5	·1	·3	111·5	1·0	24·8	9·2	52·4
	1904	8,337	450	20	3·0	·5	..	·1	90·1	·1	15·1	7·1	47·4
	1905	9,240	486	20	·6	4·0	·4	2·3	87·7	1·6	34·4	8·4	65·2
„ XII.—Hills	1901-1904	599	833	28	6·3	1·7	1·3	2·9	269·7	3·8	20·5	20·5	86·8
	1904	582	741	27	..	..	..	1·7	247·4	3·4	34·4	27·5	77·3
	1905	575	878	24	..	..	..	..	252·2	3·5	17·4	19·1	80·0
INDIA‡	1901-1904	96,370	785	32	13·0	1·0	·5	·5	268·6	2·3	7·8	13·0	89·9
	1904	90,353	676	28	4·1	·5	·3	·6	216·1	1·1	8·1	10·7	85·7
	1905	91,917	647	28	11·5	·8	·3	·7	181·7	1·2	9·7	9·7	81·6
ANDAMANS	1901-1904	13,025	1,822	59	5·3	..	..	..	1074·0	11·3	..	11·8	154·9
	1904	13,972	1,909	64	3·9	..	..	..	1173·4	8·1	..	7·6	162·5
	1905	14,348	1,898	68	13·0	..	..	..	1246·2	6·1	..	11·0	104·4
INDIA§	1901-1904	109,395	909	35	12·1	·9	·5	·5	364·5	3·4	6·8	12·9	97·6
	1904	104,325	841	33	4·1	·5	·2	·5	344·3	2·1	7·0	10·3	96·0
	1905	106,265	816	33	11·7	·7	·3	·6	325·5	1·9	8·4	9·9	92·7

* Excluding Subsidiary Jails. † The quadrennial ratios are worked on the total strength of the four years.
‡ Including Aden and excluding Andamans. § Including Andamans.

PRISONERS.

TABLE XV.—RATIOS OF ADMINISTRATIONS.

	RATIO PER 1,000 OF THE AVERAGE STRENGTH.											
	Burma.	Eastern Bengal and Assam.	Bengal.	United Provinces.	Punjab.	N.-W. Frontier Province.	Bombay.	Central Provinces.	Madras.	India,*	Andamans.	India,†
I.—AVERAGE ANNUAL STRENGTH ..	12,639	6,401	14,172	23,680	11,512	1,314	7,851	3,547	10,147	91,917	14,348	106,265
II.—CONSTANTLY-SICK-RATE OF EACH MONTH—												
January	14·4	38·6	38·2	25·6	27·9	31·2	23·1	18·1	19·6	26·1	62·0	31·1
February	14·9	41·7	45·3	26·0	27·7	34·1	23·9	18·9	19·2	27·7	66·1	33·0
March	14·6	39·0	44·9	24·3	25·8	36·1	22·2	16·3	20·8	26·7	65·0	32·0
April	16·1	43·3	43·2	26·9	24·6	45·6	24·8	18·1	19·7	27·7	65·3	32·9
May	16·2	42·5	38·1	26·7	26·9	37·0	25·9	18·5	19·1	27·1	67·8	32·7
June	16·2	42·5	36·7	25·7	27·8	31·0	25·9	13·7	17·9	26·3	76·6	33·1
July	18·3	46·2	37·3	28·1	27·6	38·1	27·9	22·3	19·1	28·3	89·2	36·5
August	18·7	47·3	41·2	28·4	27·9	33·4	32·5	25·4	19·0	29·5	77·6	35·8
September	17·7	47·6	40·0	31·0	24·9	30·3	31·6	29·9	19·9	29·6	65·8	34·4
October	17·2	42·9	38·2	27·7	21·7	31·0	30·9	26·2	22·6	27·8	60·3	32·1
November	17·3	64·3	—	25·2	21·9	27·6	30·4	20·5	19·2	27·1	57·9	31·2
December	15·9	55·5	32·7	25·7	23·3	25·7	28·9	20·3	18·0	26·2	58·2	30·5
OF THE YEAR	16·6	46·2	39·0	26·9	25·5	33·5	27·4	20·9	19·3	27·5	67·7	33·0
INCLUDING SUBSIDIARY JAILS AND LOCK-UPS	—	43·1	37·8	—	25·4	33·2	25·4	20·8	18·9	26·9	—	32·2
III.—ADMISSION-RATE OF THE YEAR—												
Influenza	1·1	16·6	9·6	20·9	7·0	141·6	—	9·0	·6	11·5	13·0	11·7
Cholera	·2	1·9	·6	·3	·5	—	—	·3	3·6	·8	—	·7
Small-pox	·2	·2	·1	·2	·3	—	1·8	—	·4	·3	—	·3
Enteric Fever	·6	1·9	·2	·4	·3	—	—	—	2·8	·7	—	·6
Intermittent Fever	51·0	260·1	290·7	181·8	246·2	344·0	134·4	190·6	85·6	181·7	1,246·2	325·5
Remittent Fever	·8	2·2	1·5	·9	·5	1·5	1·1	1·7	1·9	1·2	6·1	1·9
Simple Continued Fever	19·0	1·2	3·2	7·3	5·0	—	1·1	4·2	34·0	9·7	—	8·4
Tubercle of the Lungs	7·3	11·4	13·5	7·1	8·2	3·8	6·1	5·6	10·5	8·7	11·4	9·1
Pneumonia	3·3	8·9	6·2	12·1	14·2	13·7	13·5	9·9	8·9	9·7	11·0	9·9
Other Respiratory Diseases ..	10·7	38·9	34·1	22·0	41·2	12·2	29·0	16·6	24·8	26·4	57·4	30·6
Dysentery	28·3	307·0	196·4	36·5	28·4	45·7	41·7	41·4	64·0	81·6	164·4	92·7
Diarrhœa	17·6	90·0	90·9	21·2	42·9	30·4	39·5	36·1	3·5	39·2	55·3	41·4
Spleen Diseases	—	—	·5	1·1	·3	·8	2·5	—	·1	·6	·1	·6
Scurvy	·2	6·2	1·1	·8	·7	1·5	2·8	2·8	—	1·3	1·5	1·3
Anæmia and Debility	3·1	32·2	10·7	10·0	17·9	15·2	9·2	11·0	4·3	11·0	—	9·5
Abscess, Ulcer, and Boil	55·1	38·9	67·1	81·8	102·8	188·0	82·0	74·7	32·3	71·2	79·3	72·3
ALL CAUSES	320·3	1,031·4	953·5	568·8	707·7	960·4	602·7	629·5	469·3	646·8	1,898·3	815·8
INCLUDING SUBSIDIARY JAILS AND LOCK-UPS	—	1,031·7	947·2	—	704·2	1,008·1	606·6	630·1	558·0	655·5	—	815·5
IV.—DEATH-RATE OF THE YEAR—												
Cholera	—	1·87	·35	·17	·35	—	—	·28	1·38	·44	—	·38
Small-pox	·08	—	—	·04	·09	—	·13	—	—	·04	—	·04
Enteric Fever	·47	—	·14	·08	·09	—	—	—	·39	·16	—	·14
Intermittent Fever	·47	1·87	2·75	·51	·52	—	·13	—	·79	·91	·84	·90
Remittent Fever	·08	·47	·21	·21	·09	·76	·51	—	·20	·22	2·8	·57
Simple Continued Fever	—	—	—	—	·09	—	—	—	—	·01	—	·01
Tubercle of the Lungs	3·80	3·44	4·02	2·66	4·43	1·52	2·29	1·97	2·37	3·19	6·48	3·63
Pneumonia	1·03	2·50	2·12	3·00	2·52	1·52	3·06	1·41	1·48	2·28	4·81	2·63
Other Respiratory Diseases ..	·63	·94	1·06	1·10	·69	·76	1·53	1·13	·39	·92	·91	·92
Dysentery	2·61	7·50	6·56	1·94	·52	4·57	1·15	1·41	3·06	3·01	13·03	4·37
Diarrhœa	·95	·78	1·06	·84	·17	·76	1·15	—	·30	·74	·49	·71
Hepatic Abscess	·24	·16	·07	·04	—	—	—	—	·10	·08	·14	·08
Anæmia and Debility	·24	2·66	·49	·21	·69	—	·76	·6	·20	·54	—	·47
Phagedæna, Slough, and Gangrene	—	—	—	—	·09	—	—	—	·10	·03	—	·03
ALL CAUSES	17·01	32·96	24·91	17·31	16·33	19·79	17·45	15·79	15·87	19·23	38·90	21·90
INCLUDING SUBSIDIARY JAILS AND LOCK-UPS	—	31·10	25·38	—	16·74	19·19	17·13	·56	15·00	19·11	—	21·66
V.—PERCENTAGE IN 100 ADMISSIONS—												
Influenza	·35	1·53	1·01	3·68	·99	14·74	—	1·43	·13	1·78	·68	1·43
Cholera	·07	·17	·06	·04	·07	—	—	·04	·78	·12	—	·08
Small-pox	·05	·01	·01	·03	·04	—	·30	—	·08	·05	—	·04
Enteric Fever	·20	·17	·02	·07	·05	—	—	—	·59	·10	—	·07
Intermittent Fever	15·93	24·05	30·49	31·95	34·79	35·82	22·30	30·27	18·25	28·10	65·65	39·90
Remittent Fever	·25	·20	·16	·16	·07	·16	·19	·27	·40	·18	·32	·23
Simple Continued Fever	5·93	·12	·33	1·28	·70	—	·19	·67	7·24	1·50	—	1·03
Tubercle of the Lungs	2·27	1·05	1·42	1·25	1·15	·40	1·01	·90	2·25	1·35	·60	1·11
Pneumonia	1·04	·82	·65	2·12	2·01	1·43	2·24	1·57	1·89	1·51	·58	1·22
Other Respiratory Diseases ..	3·33	3·60	3·57	3·88	5·82	1·27	4·82	2·64	5·29	4·08	3·03	3·75
Dysentery	8·84	28·39	20·59	6·41	4·01	4·75	6·91	6·58	13·63	12·61	8·66	11·37
Diarrhœa	5·48	8·32	9·53	3·72	6·06	3·17	6·55	5·73	·76	6·06	2·91	5·07
Spleen Diseases	—	—	·05	·19	·04	·08	·42	—	·02	·10	·00	·07
Scurvy	·05	·58	·11	·14	·10	·16	·46	·45	—	·20	·08	·16
Anæmia and Debility	·96	2·98	1·12	1·77	2·53	1·58	1·52	1·75	·92	1·71	—	1·17
Abscess, Ulcer, and Boil	17·19	3·60	7·04	14·37	14·53	19·57	13·61	11·87	6·89	11·01	4·18	8·87
VI.—PERCENTAGE IN 100 DEATHS—												
Cholera	—	5·7	1·4	1·0	2·1	—	—	1·8	8·7	2·3	—	1·7
Small-pox	·5	—	—	·2	·5	—	·7	—	—	·2	—	·2
Enteric Fever	2·8	—	·6	·5	·5	—	—	—	2·5	·8	—	·6
Intermittent Fever	2·8	5·7	11·0	2·9	3·2	—	·7	—	5·0	4·8	2·1	4·1
Remittent Fever	·5	1·4	·8	1·2	·5	3·8	2·9	—	1·2	1·1	7·3	2·6
Simple Continued Fever	—	—	—	—	·5	—	—	—	—	·1	—	·0
Tubercle of the Lungs	22·3	10·4	16·1	15·4	27·1	7·7	13·1	12·5	14·9	16·6	16·6	16·6
Pneumonia	6·0	7·6	8·5	17·3	15·4	7·7	17·5	8·9	9·3	11·9	12·3	12·0
Other Respiratory Diseases ..	3·7	2·8	4·2	6·3	4·3	3·8	8·8	7·1	2·5	4·8	2·3	4·2
Dysentery	15·3	12·7	26·3	11·2	3·2	23·1	6·6	8·9	19·3	15·7	33·5	19·9
Diarrhœa	5·6	2·4	4·2	4·9	1·1	3·8	6·6	1·8	1·9	3·8	1·3	3·2
Hepatic Abscess	1·4	·5	·3	·2	—	—	—	—	·6	·4	·4	·4
Anæmia and Debility	1·4	8·1	2·0	1·2	4·3	—	4·4	3·6	1·2	2·8	—	2·1
Phagedæna, Slough, and Gangrene	—	—	—	—	·5	—	—	1·8	·6	·2	—	·1

* Including Ajmer, Secunderabad, Quetta, Mercara and excluding Andamans.
† Including Ajmer, Secunderabad, Quetta, Mercara and Andamans.

PRISONERS.

TABLE XVI.—RATIOS OF GEOGRAPHICAL GROUPS.

—	RATIOS PER 1,000 OF THE AVERAGE STRENGTH.												
	I. Burma, Coast and Bay Islands.	II. Burma Inland.	III. Assam.	IV. Bengal and Orissa.	V. Gangetic Plain and Chutia Nagpur.	VI. Upper Sub-Himalaya.	VII. N.-W. Frontier, Indus Valley, and N.-W. Rajputana.	VIII. S.-E. Rajputana, Central India, and Gujarat.	IX. Deccan.	X. Western Coast.	XI. Southern India.	XII. Hills.	India.*
I.—AVERAGE ANNUAL STRENGTH	8,808	3,831	1,391	11,901	22,083	11,930	8,407	4,346	7,017	2,318	9,240	575	91,917
II.—CONSTANTLY SICK-RATE OF EACH MONTH—													
January	12·7	18·2	32·1	46·1	24·0	27·2	28·1	32·0	21·5	19·4	20·1	17·3	26·1
February	12·9	19·3	30·8	54·5	26·6	25·2	27·9	32·1	22·8	16·9	20·4	26·5	27·7
March	11·8	20·7	27·0	52·3	26·6	24·3	25·8	26·9	21·2	16·0	21·7	20·8	26·7
April	13·3	22·4	25·6	46·6	31·9	24·3	25·8	27·7	53·9	18·9	21·1	19·4	27·7
May	15·0	18·8	31·8	40·8	30·3	25·7	26·6	28·0	26·6	18·3	20·3	24·9	27·1
June	15·0	18·7	41·3	41·1	28·5	24·9	26·6	26·0	23·6	20·5	18·5	22·5	26·3
July	16·1	23·2	49·3	40·8	30·7	24·9	27·1	34·1	29·8	24·2	19·5	30·3	28·3
August	15·9	25·1	60·7	40·6	32·1	27·9	26·5	32·1	34·9	23·7	19·1	33·6	29·5
September	14·4	25·4	62·5	38·6	35·6	25·8	24·9	31·1	37·2	20·7	20·1	37·5	29·6
October	13·8	25·6	71·3	34·8	32·0	23·1	22·5	32·3	34·2	19·3	23·1	29·7	27·8
November	16·5	19·5	118·1	39·3	27·8	21·9	23·7	29·1	29·0	23·0	19·6	29·2	27·1
December	14·4	19·8	72·5	42·1	26·2	23·9	24·4	28·1	26·8	22·6	18·3	29·2	26·2
OF THE YEAR	14·3	21·9	51·8	43·0	29·5	24·8	25·9	30·1	27·8	19·8	20·0	24·3	27·5
III.—ADMISSION-RATE OF THE YEAR—													
Influenza	—	3·7	3·6	19·9	12·7	18·7	30·9	—	4·6	—	·6	—	11·5
Cholera	—	·8	1·4	1·3	·4	·3	·4	—	·1	—	4·0	—	·8
Small-pox	·2	—	—	·1	·2	·3	1·0	·9	—	1·3	·4	—	·3
Enteric Fever	·6	·8	—	1·2	·3	·6	—	—	—	3·0	2·3	—	·7
Intermittent Fever	32·1	94·5	228·6	248·0	230·0	236·6	212·0	160·4	158·0	141·1	87·7	252·2	181·7
Remittent Fever	·8	·8	4·3	1·2	1·1	1·4	1·1	·2	1·0	1·3	1·6	3·5	1·2
Simple Continued Fever	24·6	6·0	5·8	2·7	8·0	4·8	—	—	3·4	11·6	34·4	17·4	9·7
Tubercle of the Lungs	6·4	9·4	3·6	15·9	7·9	7·5	8·7	5·5	3·8	11·2	10·8	1·7	8·7
Pneumonia	3·3	3·4	1·4	9·0	9·1	12·3	17·4	22·3	6·1	9·9	8·4	19·1	9·7
Other Respiratory Diseases	8·3	16·2	14·4	36·9	24·5	37·8	32·9	21·4	18·4	31·5	24·4	73·0	26·4
Dysentery	16·3	55·9	259·5	256·6	87·2	33·8	28·4	16·1	47·2	42·3	65·2	80·0	81·6
Diarrhœa	11·5	31·6	56·1	92·8	44·4	35·8	32·8	16·3	38·5	42·7	3·2	69·6	39·2
Spleen Diseases	—	—	—	·6	·6	·8	1·8	1·4	·4	1·3	·1	—	·6
Scurvy	·2	—	·7	3·6	1·4	·3	2·4	·2	2·1	·4	—	—	1·3
Anæmia and Debility	2·4	4·7	27·3	20·8	9·7	15·4	16·3	5·5	8·1	10·4	4·7	10·4	11·0
Abscess, Ulcer, and Boil	46·8	74·1	32·4	56·1	76·3	90·9	94·2	89·3	107·9	35·4	33·8	62·6	71·2
ALL CAUSES	261·9	454·5	867·7	1,036·1	685·9	669·0	651·1	523·5	672·1	531·5	485·5	878·3	646·8
IV.—DEATH-RATE OF THE YEAR—													
Cholera	—	—	1·44	1·09	·27	·25	·12	—	·14	—	1·52	—	·44
Small-pox	·11	—	—	—	—	·17	—	—	—	·43	—	—	·04
Enteric Fever	·34	·78	—	·08	·14	·08	—	—	—	·86	·22	—	·16
Intermittent Fever	·23	1·04	3·59	2·44	1·04	·25	·48	·23	·14	·43	·76	6·96	·91
Remittent Fever	—	·26	—	·42	·18	·25	·48	—	—	·43	·11	1·74	·22
Simple Continued Fever	—	—	—	—	—	·08	—	—	—	—	—	—	·01
Tubercle of the Lungs	3·75	3·92	2·16	4·20	3·26	2·35	4·40	2·99	1·43	4·31	2·38	—	3·19
Pneumonia	·91	1·31	·72	2·94	2·49	2·43	3·81	3·45	1·14	1·73	1·52	6·96	2·28
Other Respiratory Diseases	·57	·78	·72	1·43	1·00	·84	·25	·92	1·00	2·16	·22	1·74	·92
Dysentery	1·36	5·48	14·38	6·13	3·58	1·09	1·31	·23	1·43	4·31	2·60	5·22	3·01
Diarrhœa	·34	2·35	—	1·18	·95	·59	·24	—	·86	1·29	·32	—	·74
Hepatic Abscess	·23	·26	—	·17	·05	—	—	—	—	—	·11	—	·08
Anæmia and Debility	·23	—	—	·92	·41	·59	·48	—	·29	1·73	·22	—	·54
Phagedæna, Slough, and Gangrene.	—	—	—	—	—	·08	—	—	·14	—	·11	—	·03
ALL CAUSES	13·85	24·28	51·76	28·15	20·02	15·09	19·39	12·43	12·83	25·45	15·37	24·35	19·23
V.—PERCENTAGE IN 100 ADMISSIONS—													
Influenza	—	·80	·41	1·92	1·85	2·79	4·75	—	·68	—	·13	—	1·78
Cholera	—	·17	·17	·12	·06	·04	·05	—	·02	—	·82	—	·12
Small-pox	·09	—	—	·01	·03	·05	·15	·18	—	·24	·09	—	·05
Enteric Fever	·22	·17	—	·11	·05	·09	—	—	—	·57	·47	—	·10
Intermittent Fever	12·27	20·79	26·35	23·93	33·54	35·37	32·55	30·64	23·52	26·54	18·06	28·71	28·10
Remittent Fever	·30	·17	·50	·11	·17	·21	·16	·04	·15	·24	·33	·40	·18
Simple Continued Fever	9·41	1·32	·66	·26	1·16	·71	—	—	·51	2·19	7·09	1·98	1·50
Tubercle of the Lung	2·43	2·07	·41	1·53	1·16	1·12	1·33	1·05	·57	2·11	2·23	·20	1·35
Pneumonia	1·26	·75	·17	·87	1·32	1·84	2·67	4·26	·91	1·87	1·74	2·18	1·51
Other Respiratory Diseases	3·16	3·56	1·66	3·56	3·58	5·65	5·06	4·09	2·74	5·93	5·02	8·32	4·08
Dysentery	6·24	12·29	29·91	24·77	12·72	5·05	4·37	3·08	7·02	7·95	13·42	9·11	12·61
Diarrhœa	4·38	6·95	6·46	8·96	6·48	5·35	5·04	3·12	5·73	8·04	·65	7·92	6·06
Spleen Diseases	—	—	—	·06	·09	·11	·27	·26	·06	·24	·02	—	·10
Scurvy	·09	—	·08	·35	·20	·06	·37	·04	·32	·08	—	—	·20
Anæmia and Debility	·91	1·03	3·15	2·01	1·41	2·31	2·50	1·05	1·21	1·95	·96	1·19	1·71
Abscess, Ulcer, and Boil	17·86	16·31	3·73	5·42	11·13	13·58	14·47	17·05	16·05	6·66	6·95	7·13	11·01
VI.—PERCENTAGE IN 100 DEATHS—													
Cholera	—	—	2·8	3·9	1·4	1·7	·6	—	1·1	—	9·9	—	2·3
Small-pox	·8	—	—	—	—	1·1	—	—	—	1·7	—	—	·2
Enteric Fever	2·5	3·2	—	·3	·7	·6	—	—	—	3·4	1·4	—	·8
Intermittent Fever	1·6	4·3	6·9	8·7	5·2	1·7	2·5	1·9	1·1	1·7	4·9	28·6	4·8
Remittent Fever	—	1·1	—	1·5	·9	1·7	2·5	—	—	1·7	·7	7·1	1·1
Simple Continued Fever	—	—	—	—	—	·6	—	—	—	—	—	—	·1
Tubercle of the Lungs	27·0	16·1	4·2	14·9	16·3	15·6	22·7	24·1	11·1	16·9	15·5	—	16·6
Pneumonia	6·6	5·4	1·4	10·4	12·4	16·1	19·6	27·8	8·9	6·8	9·8	28·6	11·9
Other Respiratory Diseases	4·1	3·2	1·4	5·1	5·0	5·6	4·9	7·4	7·8	8·5	1·4	7·1	4·8
Dysentery	9·8	22·6	27·8	21·8	17·9	7·2	6·7	1·9	11·1	16·9	16·9	21·4	15·7
Diarrhœa	2·5	9·7	—	4·2	4·8	3·9	1·2	—	6·7	5·1	2·1	—	3·8
Hepatic Abscess	1·6	1·1	—	·6	·2	—	—	—	—	—	·7	—	·4
Anæmia and Debility	1·6	1·1	11·1	3·3	2·0	3·9	2·5	—	2·2	6·8	1·4	—	2·8
Phagedæna, Slough, and Gangrene.	—	—	—	—	—	·6	—	—	1·1	—	·7	—	·2

* Including Aden and excluding Andamans.

General Population.

Table XVII.—Provincial Birth and Death Statistics.

Province.	Year.	Births.			Number of Deaths.			Ratio of Deaths per 1,000 of Population.			Highest Death-rate.		Lowest Death-rate.		Mean Death-rate during previous five years.			Number of deaths of males to every 100 deaths of females.
		Total number.	Ratio per 1,000 of population.	Mean ratio per 1,000 of population during previous five years.	In municipalities and towns.	In districts, excluding towns.	Total.	In municipalities and towns.	In districts, excluding towns.	Total.	In municipalities and towns.	In districts, excluding towns.	In municipalities and towns.	In districts, excluding towns.	In municipalities and towns.	In districts, excluding towns.	Total.	
Bengal	1904*	3,170,440	42·59	39·13	130,062	2,285,361	2,415,423	34·82	32·32	32·45	90·70	48·79	7·81	17·57	35·94	32·33	32·51	108
	1905	1,973,301	39·55	38·91	128,412	1,793,957	1,922,369	40·01	38·42	38·53	92·26	59·63	7·41	22·07	·62	33·06	33·42	106
Eastern Bengal and Assam.	1904†	187,539	35·55	34·44	2,782	133,610	136,392	25·80	25·85	25·85	37·98	33·15	10·48	17·61	31·38	28·75	28·66	107·01
	1905	1,173,879	39·37	39·53	16,798	1,028,507	1,045,305	26·42	35·25	35·06	55·21	46·61	4·77	19·90	26·06	31·64	31·52	108
United Provinces of Agra and Oudh.	1904	2,225,757	46·67	44·35	165,855	1,489,094	1,654,949	49·10	33·60	34·70	149·03	46·66	23·34	19·91	45·11	32·59	33·50	99·43
	1905	1,967,009	41·24	44·07	180,482	1,917,818	2,098,300	53·64	43·26	44·00	105·71	91·24	23·64	25·38	47·13	32·78	30·80	100·11
Punjab	1904	834,049	41·5	41·4	94,152	892,306	986,458	46·74	49·31	49·06	145·42	100·50	16·63	13·61	44·2	40·27	40·6	94·9
	1905	893,360	44·4	40·5	99,151	856,957	956,108	49·13	47·37	47·55	306·36	80·10	7·10	21·31	47·63	44·58	44·88	99·1
North-West Frontier Province.	1904	69,544	34·9	31·9	4,760	52,099	56,859	28·98	28·58	28·56	44·64	29·42	13·55	26·08	28·16	23·89	24·21	107·7
	1905	70,369	35·4	32·3	5,062	48,265	53,327	30·82	26·42	26·79	44·25	28·12	16·77	23·75	28·01	25·22	25·5	110·1
Central Provinces and Berar.	1904	664,474	53·19	41·95	55,183	345,327	400,510	45·06	30·65	·32	124·53	44·92	10·15	22·39	46·36	35·04	36·13	107·40
	1905	642,199	54·02	41·78	50,627	391,756	442,383	41·87	36·69	37·2	127·05	52·17	17·07	28·43	47·43	35·52	36·73	109·85
Madras Presidency.	1904	1,125,751	30·7	29·5	119,539	704,739	824,278	26·1	21·7	22·5	71·2	38·3	3·1	13·5	33·0	20·6	21·4	103·8
	1905	1,176,256	32·0	29·4	125,944	660,179	786,123	29·6	23·3	21·4	92·2	30·6	5·6	15·4	29·8	21·1	21·9	104·3
Coorg	1904	3,970	21·97	23·78	592	4,216	4,808	38·82	25·49	26·62	61·87	33·49	24·07	18·68	45·71	30·01	31·34	124·67
	1905	4,572	25·31	23·28	490	4,249	4,739	32·13	25·70	26·24	45·99	31·52	15·74	21·70	46·22	29·92	31·30	119·20
Bombay Presidency.	1904	648,594	35·09	30·78	133,405	631,509	764,914	55·21	39·31	41·39	129·59	72·11	10·61	11·58	68·87	41·74	45·23	104·01
	1905	611,173	33·07	30·51	115,007	473,387	588,394	47·59	29·47	31·84	65·24	40·7	8·38	14·22	67·10	43·25	46·31	108·39
Lower Burma ..	1904	180,028	32·71	34·25	21,108	101,953	123,061	29·98	21·25	22·36	46·56	28·03	15·45	14·02	31·79	23·02	24·11	128
	1905	191,226	34·34	33·46	27,061	111,789	138,850	38·21	23·00	24·93	54·53	27·64	16·52	14·26	30·94	22·08	23·17	129
Upper Burma‡ ..	1904	10,393	35·05	36·72	9,230	46,441	55,671	31·13	17·32	18·69	39·82	29·48	20·05	10·71	34·06	18·30	20·08	97
	1905	10,351	34·91	37·03	10,843	54,698	65,541	36·56	20·87	22·46	62·55	30·36	24·08	15·41	33·25	17·95	19·63	99
Ajmer-Merwara ..	1904	15,997	33·54	26·81	4,784	8,365	13,149	36·90	24·09	27·57	51·87	32·61	30·41	13·99	64·48	49·80	53·79	108·52
	1905	7,802	37·32	26·38	6,603	9,729	16,332	50·94	28·01	34·25	105·20	41·10	26·40	18·28	61·74	48·02	51·75	107·11

* Including statistics for Eastern Bengal. † Excluding statistics for Eastern Bengal. ‡ Statistics for births for 12 towns only.

Table XVIII.—Births.

Province.	Population under Registration.	Ratio of Births per 1,000 of Population.			Number of Males Born to every 100 Females Born.	Excess of Births over Deaths per 1,000 of Population.	Excess Deaths over Births per 1,000 of Population.
		Maximum for any One District.	Minimum for any One District.	Mean for the Province.			
Bengal	49,891,164	51·33	18·44	39·55	105	1·02	—
Eastern Bengal and Assam	29,812,735	50·70	28·96	39·37	106	4·31	—
United Provinces of Agra and Oudh ...	47,691,782*	52·52	27·86	41·24	108·39	—	2·76
Punjab	20,108,690	67 2	21·4	44·4	109·8	—	3·2
North-West Frontier Province	1,990,744	43·3	31·7	35·4	122·6	8·6	—
Central Provinces and Berar	11,887,703	61·24	46·30	54·02	104·38	16·81	—
Madras Presidency	36,737,533	46·0	24·4	32·0	103·9	10·6	—
Coorg	180,607	38·15	19·90	25·31	95·22	—	·92
Bombay Presidency	18,481,362	46·63	17·88	33·07	108·44	1·23	—
Burma { Lower	5,568,479	42·73	17·19	34·34	106	9	—
Burma { Upper†	276,541	50·33	29·09	34·91	105	—	2
Ajmer-Merwara	476,912	45·70	34·84	37·32	116·10	3·08	—

* Includes 16,010 persons enumerated at the Ajodhya fair.
† Statistics for 12 towns only.

General Population.

Table XIX.—Deaths.

Province.	Population under Registration.	Area in Square Miles.	Average Population per Square Mile.	Ratio of Deaths per 1,000 of Population.			Death-rate by Sex.	
				Maximum for any One District.	Minimum for any One District.	Mean for the Year.	Male.	Female.
Bengal	49,891,164	107,498	464	59·86	22·05	38·53	40·07	37·00
Eastern Bengal and Assam	29,812,735	71,555	416	45·59	19·99	35·06	35·86	34·22
United Provinces of Agra and Oudh ...	47,691,782*	107,164	445	91·01	26·12	44·00	42·64	45·44
Punjab	20,108,690	97,209	207	78·5	24·5	47·6	44·1	51·6
North-West Frontier Province	1,990,744	13,688†	149	27·6	24·5	26·8	26·2	27·5
Central Provinces and Berar	11,887,703	‡	‡	54·80	28·44	37·21	39·35	35·12
Madras Presidency	36,737,533	129,241	284	59·5	16·0	21·4	22·2	20·6
Coorg	180,607	1,583	114	30·74	23·66	26·24	25·70	26·91
Bombay Presidency	18,481,362	122,984	150	62·33	15·88	31·84	32·11	31·54
Burma { Lower	5,568,479	76,992	72	45·90	15·59	24·93	26·43	23·24
Burma { Upper	2,917,501	29,411	99	30·49	15·41	22·46	23·64	21·40
Ajmer-Merwara	476,912	2,711	176	36·32	27·25	34·25	33·66	34·90

* Includes 16,010 persons enumerated at the Ajodhya fair.
† Area and population per square mile of districts include areas of Cantonments.
‡ Not available.

Table XX.—Deaths in Towns and Rural Circles compared.

Province.	Number of Registration Circles.			Population.			Ratio of Deaths per 1,000 of Population.		
	Rural.	Town.	Total.	Rural.	Town.	Total.	Rural.	Town.	Total.
Bengal	387	127	514	46,682,139	3,209,025	49,891,164	38·42	40·01	38·53
Eastern Bengal and Assam	242	54	296	29,177,017	635,718	29,812,735	35·25	26·42	35·06
United Provinces of Agra and Oudh ...	856	448	1,304	44,327,116*	3,364,666	47,691,782*	43·26	53·64	44·00
Punjab	404	145	549	18,090,573	2,018,117	20,108,690	47·37	49·13	47·55
North-West Frontier Province ...	64	10	74	1,826,493	164,251	1,990,744	26·42	30·82	26·79
Central Provinces and Berar	233	99	332	10,678,534	1,209,169	11,887,703	36·69	41·87	37·21
Madras Presidency	185	232	417	32,487,484	4,250,049	36,737,533	20·3	29·6	21·4
Coorg	5	5	10	165,358	15,259	180,607	25·70	32·13	26·24
Bombay Presidency	224	56	280	16,065,004	2,416,358	18,481,362	29·47	47·59	31·84
Burma { Lower	201	40	241	4,860,314	708,165	5,568,479	23·00	38·21	24·93
Burma { Upper	107	19	126	2,620,960	296,541	2,917,501	20·87	36·56	22·46
Ajmer-Merwara	17	6	23	347,280	129,632	476,912	28·01	50·94	34·25

* Includes 16,010 persons enumerated at the Ajodhya fair.

Table XXI.—Deaths according to Age.

Province.	Ratio per 1,000 of Population.																	
	Under 1 Year.		1-5 Years.		5-10 Years.		10-15 Years.		15-20 Years.		20-30 Years.		30-40 Years.		40-50 Years.		50-60 Years.		60 Years and Upwards.	
	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.
Bengal	320·63	276·40	61·95	55·33	23·30	20·15	17·53	16·91	19·47	18·64	22·58	21·55	25·31	23·02	31·50	26·74	47·28	44·18	95·90	80·06
Eastern Bengal and Assam.	265·48	227·04	55·06	47·63	21·17	16·16	15·08	14·20	20·60	24·83	20·09	24·16	22·50	24·35	27·35	25·63	40·65	38·02	77·71	63·82
United Provinces of Agra and Oudh.	361·29	341·19	64·11	65·42	20·80	22·30	16·82	20·20	20·35	26·92	23·01	27·50	25·80	28·58	33·72	34·26	52·75	51·43	92·86	83·21
Punjab	320·92	318·90	57·39	61·	20·32	26·37	22·75	34·29	25·29	31·99	25·38	30·57	27·91	35·47	36·53	42·26	47·25	55·17	92·30	104·87
North-West Frontier Province.	211·28	167·09	41·33	39·20	8·76	9·77	6·75	8·68	7·08	9·73	10·48	14·47	13·63	19·43	21·01	24·72	33·63	33·43	65·94	69·57
Central Provinces and Berar.*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Madras Presidency ..	200·7	165·9	27·4	25·8	7·4	7·1	5·3	5·0	8·0	11·3	9·8	10·6	11·9	10·9	18·0	13·3	29·1	24·1	70·3	65·4
Coorg	179·58	173·88	37·89	27·28	9·88	9·20	7·74	8·38	10·88	12·52	18·74	21·56	21·10	25·22	32·35	29·75	46·02	44·92	72·14	67·68
Bombay Presidency ..	351·52	317·73	55·09	52·36	12·06	12·76	10·87	12·61	15·76	17·76	17·42	18·51	19·45	19·02	26·47	20·96	40·77	32·66	88·31	80·00
Burma { Lower ..	336·79	239·88	30·28	26·54	14·46	12·33	10·11	9·06	14·51	11·96	14·63	12·69	16·97	16·26	21·24	18·22	25·79	23·36	56·94	54·47
Burma { Upper ..	245·78	177·57	26·02	23·82	9·97	8·78	6·23	5·09	9·08	7·48	10·05	10·04	12·48	13·75	16·14	14·19	26·58	20·83	66·13	60·51
Ajmer-Merwara ..	247·73	244·37	72·34	73·40	10·90	11·31	12·09	12·15	14·89	20·05	19·77	22·91	23·05	22·31	26·67	24·96	45·75	41·19	85·73	79·59

* Information not available.

General Population.

Table XXII.—Deaths according to Cause.

Province.	Deaths per 1,000 of Population in 1905.									Ratio of Deaths in 1904.	Ratio of Deaths in 1903.
	Cholera.	Small-pox.	Plague.	Fevers.	Dysentery and Diarrhœa.	Respiratory Diseases	Injuries.	All other Causes.	All Causes.		
Bengal	2·93	·14	2·52	24·34	·90	·22	·49	6·95	38·53	31·95	33·33*
Eastern Bengal and Assam	4·77	·15	·0002	23·68	·85	·06	·36	5·15	35·06	25·85†	26·55†
United Provinces of Agra and Oudh ...	2·55	·07	8·05	26·92	·56	·49	·51	4·85	44·00	34·70	40·28
Punjab	·11	·23	16·65	18·40	·68	3·05	1·24	7·17	47·55	49·06	49·01
North-West Frontier Province	·15	·29	·002	20·69	·28	·57	·32	4·49	26·79	28·56	28·40
Central Provinces and Berar	·10	·70	1·07	17·43	3·02	1·30	·54	1·35	37·21	32·06	35·52
Madras Presidency	·5	·5	·2	7·2	1·4	·5	·3	10·8	21·4	22·5	22·2
Coorg	—	·73	—	21·46	·53	·17	·14	3·21	26·24	26·62	31·43
Bombay Presidency	·29	·92	3·86	13·28	3·00	2·95	·36	7·18	31·84	41·39	43·91
Burma { Lower	·63	1·01	·55	8·97	1·43	·73	·27	11·35	24·93	22·36	24·13
Burma { Upper	·63	·18	·22	6·76	·44	·56	·38	13·28	22·46	18·69	21·80
Ajmer-Merwara	—	·58	5·20	21·67	·89	1·18	·30	4·43	34·25	27·57	28·77

* Including statistics for Eastern Bengal.
† Excluding statistics for Eastern Bengal.

Table XXIII.—Total Number of Deaths by Months.

Province.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Ratios per 1,000 of Population.	
														1905.	1904.
Bengal	178,057	142,466	155,308	154,814	157,130	126,728	111,405	139,445	155,738	203,774	204,920	192,584	1,922,369	38·53	31·95
Eastern Bengal and Assam.	111,752	67,897	58,993	66,026	88,141*	70,929	65,490	60,455	72,345	112,444	128,173	142,660	1,045,305	35·06	25·85*
United Provinces of Agra and Oudh.	195,863	185,943	241,787	219,150	171,989	137,221	121,520	114,068	141,299	179,533	200,146	189,781	2,098,300	44·00	34·70
Punjab	81,296	75,103	113,840	174,295	147,800	59,963	47,984	49,416	44,171	47,567	53,855	60,818	956,108	47·55	49·06
North-West Frontier Province.	4,454	4,565	4,224	4,024	4,098	4,619	5,162	4,052	4,090	3,817	4,384	5,838	53,327	26·79	28·56
Central Provinces and Berar.	31,084	33,990	30,011	34,854	39,389	37,764	29,036	34,447	46,144	45,959	41,408	38,297	442,383	37·21	32·06
Madras Presidency ..	69,329	58,202	58,268	57,161	58,792	63,968	67,159	71,333	67,959	69,794	67,432	76,726	786,123	21·4	22·5
Coorg	365	258	360	377	406	479	544	490	344	374	317	425	4,739	26·24	26·62
Bombay Presidency ..	60,999	58,252	58,721	55,960	47,584	39,639	39,300	44,984	45,761	44,167	45,121	47,906	588,394	31·84	41·39
Burma, Lower	10,536	9,072	9,503	10,613	10,434	10,825	12,747	13,419	13,004	13,171	12,877	12,649	138,850	24·93	22·36
„ Upper	5,062	4,012	4,427	4,620	4,652	4,596	5,533	5,930	5,947	6,049	7,299	7,414	65,541	22·46	18·69
Ajmer-Merwara ..	1,196	1,565	2,617	3,022	1,673	831	783	994	868	863	927	993	16,332	34·25	27·57
Total	749,993	641,325	738,059	784,916	732,088	557,562	506,663	539,033	597,670	727,512	766,859	776,091	8,117,771	35·96	32·86

* Excluding districts of Eastern Bengal.

Table XXIV.—Ratio of Deaths from all Causes according to Months.

Province.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Bengal	3·56	2·85	3·11	3·10	3·14	2·54	2·23	2·79	3·12	4·08	4·10	3·86	38·53
Eastern Bengal and Assam	3·74	2·27	1·97	2·21	2·95	2·37	2·19	2·02	2·42	3·77	4·29	4·78	35·06
United Provinces of Agra and Oudh ...	4·11	3·90	5·07	4·59	3·61	2·88	2·55	2·39	2·96	3·76	4·20	3·98	44·00
Punjab	4·04	3·73	5·66	8·67	7·35	2·98	2·39	2·46	2·20	2·37	2·68	3·02	47·55
North-West Frontier Province	2·24	2·29	2·12	2·02	2·06	2·32	2·59	2·04	2·05	1·92	2·20	2·93	26·79
Central Provinces and Berar	2·61	2·86	2·53	2·93	3·31	3·18	2·44	2·90	3·88	3·87	3·48	3·22	37·21
Madras Presidency	1·9	1·6	1·6	1·6	1·6	1·7	1·8	1·9	1·9	1·9	1·9	1·8	21·4
Coorg	2·02	1·43	1·99	2·09	2·25	2·65	3·01	2·70	1·90	2·07	1·76	2·36	26·24
Bombay Presidency...	3·30	3·15	3·18	3·03	2·58	2·14	2·13	2·43	2·48	2·39	2·44	2·59	31·84
Burma { Lower	1·89	1·63	1·71	1·91	1·87	1·94	2·29	2·41	2·34	2·37	2·31	2·27	24·93
Burma { Upper	1·74	1·38	1·52	1·58	1·59	1·58	1·90	2·03	2·04	2·07	2·50	2·54	22·46
Ajmer-Merwara	2·51	3·28	5·49	6·34	3·51	1·74	1·64	2·08	1·82	1·81	1·94	2·08	34·25

TABLE XXV.—DEATHS FROM CHOLERA IN THE DIFFERENT PROVINCES IN INDIA FROM 1885 TO 1905.

YEAR.	Bengal.*	Assam.	United Provinces of Agra and Oudh.	Punjab.	North-West Frontier Province.†	Central Provinces.‡	Berar.	Madras.	Coorg.	Bombay.	Lower Burma.	Upper Burma.§	Ajmer-Merwara.	Rajputana.	Central India.	Hyderabad (Cantonment Stations).	Mysore.
1885	173,767	7,753	63,457	1,936	—	21,868	3,683	58,109	—	37,287	7,685	—	100	1,615	4,624	1,387	2,677
1886	118,368	20,188	34,565	12	—	16,679	976	12,417	—	167	4,027	—	765	173	290	499	10
1887	172,578	7,941	200,628	8,804	—	12,576	14,396	28,359	3	25,711	2,649	—	384	2,612	8,868	2,831	832
1888	111,391	9,693	18,704	14,938	—	921	305	58,677	2	36,500	15,982	—	13	32	191	2,057	1,015
1889	171,103	18,288	48,494	2,838	—	52,588	10,925	76,020	9	32,431	3,240	—	55	6,923	3,344	1,128	1,590
1890	145,885	15,396	80,295	3,401	—	4,787	847	35,288	5	3,259	1,076	—	408	2,746	3,132	—	1,326
1891	229,575	23,882	169,013	10,107	—	21,312	7,958	98,773	7	17,850	2,400	—	532	2,946	13,474	3,102	1,204
1892	259,398	21,552	194,686	75,959	—	39,972	2,030	79,033	58	42,900	6,208	—	2,352	26,760	8,384	53	5,497
1893	126,476	21,849	12,154	639	—	557	1,188	32,209	9	18,853	2,393	—	3	314	127	165	680
1894	236,150	13,497	178,079	113	—	7,043	3,452	42,289	8	33,588	7,428	—	—	2	5,210	1,862	328
1895	177,087	18,962	51,562	549	—	15,506	11,919	21,172	—	8,890	5,150	—	289	1,049	6,043	467	2,334
1896	226,824	17,042	69,147	5,146	—	52,985	12,264	47,847	49	35,494	2,959	—	12	3,797	15,766	525	2,100
1897	196,247	33,240	44,208	622	—	57,131	10,122	143,445	106	57,109	8,538	—	19	1,496	13,202	1,039	4,248
1898	65,020	11,149	2,508	33‖	—	7	—	65,444	8	4,368	2,972	—	1	6	2	6	1,193
1899	107,678	8,380	8,142	1,816	—	766¶	541	29,082	—	8,579	4,942	2,050	1	498	—	—	123
1900	345,878	23,761	84,960	28,260	—	63,114	16,375	60,662	—	163,889	3,440	41	4,842	28,719	20,450	3,813	779
1901	110,753	7,468	53,995	180	117	49	17	81,370	58	13,600	3,552	**	50	6	72	1	11,351
1902	150,971	12,658	25,160	371	—	28	16	29,769	—	3,230	1,844	57	32	1,519	12	—	218
1903	203,405	8,360	47,159	14,688	1,354	437	—	27,393	—	1,825	5,346	2,887	—	236	1,110	—	98
1904	137,701	5,588	6,617	716	1	2,967	—	23,109	—	13,156	2,472	508	—	1	150	—	471
1905	146,339	142,312††	121,790	2,197	300	1,217	—	16,888	—	5,396	3,511	1,836	—	3	27	64	626

* Excluding Calcutta from 1885 to 1892.
† 1885 to 1900 included in the Punjab.
‡ Including Berar from 1903.
§ Statistics from 1885 to 1898 not available.
‖ Including 30 deaths in cantonments.
¶ Excluding Zamindaris.
** Statistics not available.
†† Eastern Bengal and Assam.

TABLE XXVI.—DEATHS FROM CHOLERA IN BRITISH PROVINCES, BY MONTHS, DURING THE YEAR 1905.

PROVINCE.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL.	RATIO PER 1,000 OF POPULATION. 1905.	1904.
Bengal	12,040	5,403	4,885	5,674	3,618	2,929	5,159	9,911	16,798	26,274	30,977	22,671	146,339	2·93	1·63
Eastern Bengal and Assam ..	9,179	1,439	1,230	2,479	3,098	1,659	1,285	1,664	9,938	28,649	39,982	41,710	142,312	4·77	2·07
United Provinces of Agra and Oudh.	56	28	64	472	1,893	2,315	2,318	3,495	12,215	28,418	46,923	23,593	121,790	2·55	·14
Punjab	—	—	—	—	13	36	324	688	909	174	51	2	2,197	·11	·04
North-West Frontier Province	—	—	—	—	—	—	—	—	169	126	5	—	300	·15	·001
Central Provinces and Berar	—	—	—	—	2	64	195	249	500	170	12	25	1,217	·01	·24
Madras Presidency	26	16	20	5	42	449	1,268	4,191	3,717	3,680	1,499	1,975	16,888	·5	·6
Coorg	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Bombay Presidency	51	49	133	777	871	1,980	879	340	225	62	27	2	5,396	·29	·71
Burma {Lower	331	413	292	271	216	44	68	113	326	571	481	385	3,511	·63	·45
Burma {Upper	—	1	10	70	31	59	125	194	134	211	580	421	1,836	·63	·17
Ajmer-Merwara	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TOTAL	21,683	7,349	6,634	9,748	9,784	9,535	11,621	20,845	44,931	88,335	120,537	90,784	441,786	1·96	·85

TABLE XXVII.—DETAILS OF THE DISTRIBUTION AND OCCURRENCE OF CHOLERA DURING THE YEAR 1905.

PROVINCE.	Mortality in 1905.	Mean mortality of previous 5 years.	Urban mortality.	Rural mortality.	Percentage of villages attacked.	Maximum mortality in any one district excluding towns.	Maximum mortality in any one town.	Month of maximum mortality.
Bengal	2·93	2·77	3·85	2·86	13·90	6·41	12·94	November.
Eastern Bengal and Assam	4·77	2·10	4·52	4·77	20·81	10·60	17·66	December.
United Provinces of Agra and Oudh ...	2·55	·92	·64	2·70	7·84	25·30	13·48	November.
Punjab	·11	·41	·32	·09	·90	1·26	13·78	September.
North-West Frontier Province	·15	·48	·38	·13	1·30	·44	7·40	September.
Central Provinces and Berar	·10	Not available	·07	·11	·46	·53	4·57	September.
Madras Presidency	·5	1·2	1·2	·4	4·24	3·2	16·1	August.
Coorg	—	·06	—	—	—	—	—	—
Bombay Presidency	·29	2·08	·20	·31	1·84	1·95	6·26	June.
Burma {Lower	·63	·63	1·04	·57	4·16	4·59	18·98	October.
Burma {Upper	·63	·25	1·47	·53	3·48	1·39	9·10	November.
Ajmer-Merwara	—	2·07	—	—	—	—	—	—

General Population.

Table XXVIII.—Small-pox Mortality.

Provinces, Districts, Towns,	Bengal.	Eastern Bengal and Assam.	United Provinces.	Punjab.	North-West Frontier Province.	Central Provinces and Berar.	Lower Burma.	Upper Burma.	Madras Presidency.	Bombay Presidency.	Ajmer-Merwara.	Coorg.	Registration India.
I.—Mortality by Provinces:—													
A.—Deaths by months—													
January	619	304	167	306	81	378	162	19	1,338	2,254	65	2	5,695
February	544	252	149	220	66	625	251	9	1,315	3,828	78	2	7,339
March	718	399	195	249	46	786	527	33	1,629	3,883	60	15	8,540
April	359	395	316	278	45	1,214	731	84	1,458	3,023	42	12	8,457
May	1,190	690	492	420	43	1,355	868	132	1,469	1,532	25	11	8,227
June	756	781	475	515	38	1,107	747	78	1,336	643	4	18	6,498
July	533	620	337	428	65	821	641	46	1,274	309	—	25	5,099
August	313	323	231	324	14	552	442	24	1,562	204	—	13	4,002
September	325	325	155	219	15	389	271	29	1,417	171	1	6	3,323
October	262	211	86	163	26	195	258	46	1,716	287	—	10	3,260
November	303	191	207	486	28	283	320	30	1,720	381	—	8	3,957
December	791	232	463	1,115	104	659	405	8	2,306	470	2	10	6,565
Total	7,213	4,723	3,273	4,723	571	8,364	5,623	538	18,540	16,985	277	132	70,963
B.—Annual death ratios—													
Ratio per 1,000 of population, 1905.	·14	·15	·07	0·23	0·29	0·70	1·01	·18	0·5	·92	·58	·73	·31
Ratio per 1,000 of population, 1904.	·22	·26	·15	·48	·78	·16	·24	·17	·3	·23	·27	·09	·24
Difference ..	−·08	−·11	−·08	−·25	−0·49	+0·54	+0·77	+·01	+·02	+·69	+·31	+·64	+·07
Mean ratio per 1,000 during 1900–1904.	·54	·27	·15	0·52	0·77	Not available.	·36	·41	0·6	0·26	1·15	·93	0·40
Difference ..	−·40	−·12	−·08	−·29	−·48	—	+·65	−·23	−·1	+·66	−·57	−·20	−·09
II.—District mortality excluding towns:—													
Number of districts affected.	30	22	48	28	4	23	14	10	22	24	9	5	239
Highest district ratio ..	1·89	2·82	1·63	0·77	0·69	2·62	2·34	1·52	1·4	5·54	1·34	1·58	5·54
Name of that district ..	Puri	Kamrup	Jhansi	Ferozepore.	Hazara	Saugor	Hanthawaddy.	Mandalay	Madura	Khandesh.	Pokhar	Yedenalknad.	Khandesh
Lowest district ratio ..	·002	·004	·001	0·01	0·004	0·05	0·002	·01	0·002	0·02	·05	·18	·001
Name of that district ..	Ranchi	Maida	Saharanpur.	Kangra	Dera-Ismail Khan.	Chhindwara.	Akyab	Kyaukse	Vizagapatam.	Belgaum	Sawar	Naujaraj-patan.	Saharanpur.
Number of districts without mortality.	1	None.	None.	1	1	None.	4	1	None	None	8	None	16
District death-rate per 1,000 of population.	·13	·15	·07	0·20	0·29	0·65	·82	·18	0·5	·73	·16	·71	0·27
III.—Town mortality:—													
Number of towns affected	59	17	33	76	6	70	25	3	105	43	3	3	443
Highest town ratio.. ..	2·99	6·34	·61	9·09	0·59	10·68	13·20	4·03	8·0	8·39	3·00	2·34	13·20
Name of that town ..	Kishanganj.	Tezpur	Benares	Ludhiana	Abbottabad.	Mohpa	Danubyu	Pyinmana	M. T. C. Dindigul.	Shikarpur.	Ajmer Town.	Virajendrapet.	Danubyu
Lowest town ratio	·03	·04	·006	0·01	0·04	0·07	·08	·01	0·01	·02	·23	·44	·006
Name of that town ..	South Suburban.	Narayanganj.	Allahabad.	Delhi	Dera Ismail Khan.	Jubbulpur.	Akyab	Mandalay	M. T. C. Calicut.	Broach	Pisangan Town.	Mercara	Allahabad
Number of towns without mortality.	68	37	74	69	4	29	14	9	127	20	3	2	456
Town death-rate per 1,000 of population.	·22	·37	·05	0·59	0·20	1·19	2·34	·21	0·8	2·18	1·71	·98	0·78
IV.—Infantile mortality:—													
Children under 1 year ..	1,350	802	1,336	1,195	118	2,938	402	34	7,177	6,113	88	—	21,553
Children 1–10 years ..	3,247	2,223	1,689	2,664	358	3,162	1,487	196	6,513	8,197	172	—	29,908
Percentage of children in total small-pox mortality	63·73	64·05	92·42	81·71	83·36	72·93	33·59	42·75	73·84	84·25	93·86	—	72·52

General Population.

Table XXIX.—Fever Mortality.

Provinces, Districts, and Towns.	Bengal.	Eastern Bengal and Assam.	United Provinces.	Punjab.	North-West Frontier Province.	Central Provinces and Berar.	Lower Burma.	Upper Burma.	Madras Presidency.	Bombay Presidency.	Ajmer Merwara.	Coorg.	Registration India.
I.—Mortality by Provinces:—													
A.—Deaths by months—													
January	102,612	81,708	105,831	33,210	3,570	13,057	4,625	1,985	23,332	24,759	871	315	395,875
February	79,120	52,328	96,687	30,474	3,721	14,037	3,548	1,345	19,540	23,882	1,003	220	325,905
March	77,431	45,070	101,995	33,505	3,325	13,009	3,514	1,649	19,952	23,730	1,392	295	324,867
April	88,811	49,777	101,931	30,063	3,166	16,120	3,815	1,639	20,467	22,556	1,175	316	339,836
May	107,131	66,937	107,076	31,255	3,256	19,652	3,512	1,531	20,046	19,391	1,007	324	381,118
June	91,031	54,875	106,619	31,142	3,643	19,482	3,774	1,407	22,374	15,919	639	410	351,315
July	75,875	50,946	94,937	28,471	3,987	13,503	4,545	1,541	22,209	15,589	625	440	312,668
August	92,075	46,160	85,289	28,902	2,976	15,093	4,729	1,431	22,416	17,112	811	382	317,376
September	100,586	48,476	100,303	25,519	2,919	20,994	4,404	1,462	21,741	17,117	680	280	344,481
October	135,087	65,080	122,263	28,383	2,825	22,440	4,143	1,616	22,374	18,224	680	296	423,411
November	136,426	68,121	126,370	32,731	3,298	21,305	4,445	1,928	23,910	22,516	705	254	444,009
December	128,302	76,782	134,863	36,392	4,504	18,503	4,901	2,194	26,683	24,578	748	344	458,794
Total	1,214,487	706,260	1,284,164	370,047	41,190	207,195	49,955	19,728	265,044	245,373	10,336	3,876	4,417,655
B.—Annual death ratios—													
Ratio per 1,000 of population, 1905.	24·34	23·68	26·92	18·40	20·69	17·43	8·97	6·76	7·2	13·28	21·67	21·46	19·57
Ratio per 1,000 of population, 1904.	20·49	23·60	23·92	18·82	22·30	13·54	9·91	7·05	8·0	13·60	21·83	22·45	18·09
Difference ..	+3·85	+·08	+3·00	−·42	−1·61	+3·89	−·94	−·29	−0·8	−0·32	−0·16	−0·99	+1·48
Mean ratio per 1,000 during 1900-1904.	21·14	23·23	24·63	25·05	19·01	Not available.	9·68	7·22	8·2	17·40	38·38	25·43	19·60
Difference ..	+2·20	+0·45	+2·29	−6·65	+1·68	—	−0·71	−0·46	−1·0	−4·12	−16·71	−3·97	−0·03
II.—District mortality excluding towns:—													
Number of districts affected.	31	22	48	29	5	23	18	11	22	24	17	5	255
Highest district ratio ..	39·10	36·34	38·01	23·44	25·23	39·81	15·50	12·94	16·6	27·84	32·27	28·95	39·81
Name of that district ..	Shahabad	Dinajpur.	Saharanpur.	Attock	Peshawar.	Nimar	Akyab	Mandalay.	Vizagapatam.	Ahmedabad.	Ghegal	Nanjarajpatna.	Nimar
Lowest district ratio ..	7·56	8·73	18·33	4·62	17·30	7·65	4·90	3·92	1·7	5·54	14·62	16·87	1·7
Name of that district ..	Puri	Sylhet	Almora	Simla	Hazara	Buldana	Amherst	Meiktila	Bellary	Belgaum	Dewair	Yedenalknad.	Bellary
Number of districts without mortality.	None	None	None	None	None	None	None	None	None	None	None	None.	None
District death rate per 1,000 of population.	25·10	23·92	26·92	18·47	21·08	18·03	9·29	6·83	7·4	13·90	21·81	22·17	20·11
III.—Town mortality:—													
Number of towns affected	127	54	107	145	10	99	39	12	228	63	6	5	895
Highest town ratio.. ..	41·40	33·75	50·05	37·98	23·66	31·59	21·01	9·40	20·1	52·26	39·26	23·75	52·26
Name of that town ..	Murshidabad.	Mangaldai.	Brindaban.	Shahiwal	Haripur	Wadigaon	Myaungmya.	Monywa	T. C. Srungavarapukota.	Umarkot	Beawar Town.	Fraserpet	Umarkot
Lowest town ratio	2·78	1·71	11·20	2·00	6·25	0·64	2·89	1·73	0·1	·35	12·98	·70	0·1
Name of that town ..	Ulubaria	Jhalakati.	Konch	Phillour	Kulachi	Deulgaon Raja.	Moulmein	Minbu	T. C. Ettiyapuram.	Deolali Cantonment.	Ajmer Town.	Virajendrapet.	Ettiyapuram.
Number of towns without mortality.	None	None	None	None	None	None	None	None	4	None	None	None	4
Town death-rate per 1,000 of population.	13·18	12·89	26·98	17·79	16·57	12·16	6·80	6·17	5·3	9·15	21·30	13·77	13·51

General Population.

Table XXX.—Dysentery and Diarrhœa Mortality.

Provinces, Districts and Towns.	Bengal.	Eastern Bengal and Assam.	United Provinces.	Punjab.	North-West Frontier Province.	Central Provinces and Berar.	Lower Burma.	Upper Burma.	Madras Presidency.	Bombay Presidency.	Ajmer-Merwara.	Coorg.	Registration India.
I.—Mortality by Provinces—													
A.—Deaths by months—													
January	4,065	1,654	1,811	859	26	1,645	629	44	4,159	4,853	24	5	19,774
February	3,149	954	1,467	742	25	1,636	482	33	3,680	4,111	21	3	16,303
March	3,209	910	1,398	729	35	1,477	444	59	3,613	4,066	33	1	16,065
April	3,462	1,511	1,720	849	16	1,999	503	75	3,543	4,164	78	5	17,925
May	3,704	2,982	2,613	1,520	43	2,464	606	73	3,913	4,883	49	13	22,863
June	2,823	2,649	3,069	1,439	47	2,171	659	125	4,851	4,538	31	14	22,416
July	2,953	2,130	3,056	1,273	47	2,323	884	176	5,579	5,269	23	11	23,724
August	3,928	1,712	2,512	1,344	85	4,410	814	221	5,361	6,788	38	17	27,230
September	4,235	1,960	2,389	1,295	76	6,427	85	121	4,264	5,776	32	7	27,436
October	4,917	2,690	2,191	1,271	57	5,109	669	117	4,170	4,141	33	9	25,374
November	4,349	3,148	2,176	1,243	54	3,458	691	156	3,849	3,347	31	7	22,509
December	4,466	2,282	2,130	1,198	51	2,760	711	104	4,316	3,452	31	4	22,505
Total	45,260	25,582	26,532	13,762	562	35,879	7,946	1,295	51,298	55,488	424	96	264,124
B.—Annual death ratios—													
Ratio per 1,000 of population, 1905.	·90	·85	·56	0·68	0·28	3·02	1·43	·44	1·4	3·00	·89	·53	1·17
Ratio per 1,000 of population, 1904.	·82	·62	·50	·60	·31	2·14	1·27	·31	1·3	3·33	·78	·50	1·06
Difference ..	+·08	+·23	+·06	+0·08	−0·03	+0·88	+0·16	+·13	+0·1	−0·33	+·11	+·03	+·11
Mean ratio per 1,000 during 1900-1904.	·99	·65	·63	0·82	0·28	Not available.	1·48	·33	1·2	4·87	4·44	·84	1·37
Difference ..	−·09	+·20	−·07	−·14	..	..	−·05	+·11	+·2	−1·87	−3·55	−·31	−0·20
II.—District mortality excluding towns—													
Number of districts affected.	31	22	48	29	5	23	18	11	22	24	11	5	249
Highest district ratio ..	4·19	6·67	11·39	3·22	0·86	11·34	2·90	·65	4·3	9·73	1·77	·67	11·39
Name of that district ..	Patna	Lakhimpur.	Garhwal	Simla	Dera Ismail Khan.	Akola	Tavoy	Myingyan.	The Nilgiris.	Khandesh.	Pohkar	Kiggatnad	Garhwal
Lowest district ratio ..	·02	·02	·01	0·14	0·03	0·15	·57	·05	0·2	·03	·03	·07	·01
Name of that district ..	Purnea	Dinajpur	Gonda	Gujranwala.	Peshawar.	Bhandara.	Toungoo	Kyauksi	Vizagapatam.	Larkana	Masuda	Padinalknad Taluk.	Gonda
Number of districts without mortality.	None	None	None	None	None	None	None	None	None	None	6	None	6
District death-rate per 1,000 of population.	·75	·83	·43	0·53	0·19	2·93	1·11	·43	1·1	2·91	·22	·31	1·00
II.—Town mortality—													
Number of towns affected	122	54	95	141	10	97	39	12	207	60	4	3	844
Highest town ratio ..	8·30	16·02	10·93	10·82	2·85	20·26	7·58	2·64	11·2	10·87	4·92	7·00	20·26
Name of that town ..	Hooghly and Chinsurah.	North Lakhimpur.	Ballia	Kalabagh.	Kulachi	Jaigaon	Thayetmyo	Pyinwana.	M. T. C. Madras.	Poona	Ajmer Suburb.	Virajendrapet.	Jalgaon
Lowest town ratio	·11	·07	·02	0·15	0·22	0·12	·16	·10	0·1	·19	·14	1·12	·02
Name of that town ..	Baraset	Pirojpur	Meerut	Eminabad.	Kohat	Morsi	Danubyu	Shwebo	T. C. Sivagiri.	Jacobabad.	Kekrt Town.	Kodlipet	Meerut
Number of towns without mortality.	5	None	12	4	None	2	None	None	25	3	2	2	5·5
Town death-rate per 1,000 of population.	3·13	1·90	2·19	2·11	1·28	3·77	3·57	·60	4·0	3·61	2·69	2·95	3·06

General Population.

Table XXXI.—Plague Mortality.

Province or State.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total. 1905.	Total. 1904.
British Provinces:—														
Bengal	20,903	22,915	40,090	26,486	8,891	1,512	142	245	403	514	1,255	2,728	126,084	73,133
Eastern Bengal and Assam	..	..	2	1	3	..	..	..	..	..	..	..	6	3
United Provinces of Agra and Oudh.	63,929	65,540	116,299	91,055	35,067	3,121	386	441	546	706	1,858	4,854	383,802	179,082
Punjab	29,643	27,262	61,650	112,374	90,885	9,039	548	185	129	235	1,167	1,780	334,897	396,357
North-West Frontier Province	..	..	2	..	1	..	..	..	..	..	..	..	3	1
Central Provinces and Berar	2,040	2,000	2,072	1,044	212	14	1	137	1,192	2,108	1,018	868	12,706	42,868
Burma { Lower	1	61	173	573	360	403	524	325	232	161	127	105	3,045	3
Burma { Upper	..	..	..	1	..	..	92	76	41	46	157	234	647	..
Madras Presidency	1,700	1,016	458	239	59	31	94	436	859	405	269	222	5,788	20,125
Bombay	11,069	9,161	10,526	8,405	4,353	1,582	2,016	4,469	7,258	6,549	3,516	2,459	71,363	223,957
Ajmer-Merwara	33	170	665	1,272	315	..	1	4	1	1	15	3	2,480	158
Coorg	..	..	..	..	..	..	..	..	..	..	..	..	..	25
Total { 1905	129,318	128,125	231,937	241,450	140,146	15,702	3,804	6,318	10,661	10,725	9,382	13,253	940,821	..
Total { 1904	75,936	100,488	170,841	204,962	121,992	17,896	8,185	22,182	35,970	50,030	50,445	79,083	..	938,010
Native States, etc.:—														
Punjab Native States	5,021	6,684	12,619	18,759	11,236	171	2	..	..	..	104	272	54,868	38,210
Jammu and Kashmir State	69	84	229	965	1,110	95	1	..	..	7	20	89	2,669	8,691
Native States in Central Provinces	..	..	..	..	..	..	..	..	..	..	..	..	..	101
Madras Native States	..	..	..	..	..	..	..	..	..	..	..	..	..	4
Bombay Presidency Native States	3,091	2,600	3,500	2,467	1,071	354	307	1,348	2,571	2,575	1,863	1,263	23,010	63,347
Baluchistan	..	..	..	..	..	..	..	..	..	..	..	..	..	25
United Provinces (Tehri Garhwal)	..	..	..	..	..	..	..	..	..	..	24	8	32	..
Rajputana	2,548	1,977	5,219	11,926	7,416	556	19	283	1	43	50	45	30,083	19,268
Central India	383	373	496	279	60	1	10	96	146	290	490	212	2,836	26,545
Mysore	963	911	493	174	47	48	178	365	198	177	177	228	3,959	21,622
Bangalore Civil and Military Station.	232	196	105	60	57	70	75	90	158	279	264	268	1,854	2,574
Hyderabad State	2,658	1,795	1,776	794	292	..	27	202	373	437	358	296	9,008	25,596
Total { 1905	14,905	14,620	24,437	35,424	21,289	1,295	619	2,384	3,447	3,808	3,350	2,681	128,319	..
Total { 1904	18,398	19,891	29,064	40,209	10,803	2,573	4,437	12,121	18,906	20,043	16,437	12,702	..	205,983
Grand Total { 1905	144,283	142,745	256,374	276,874	161,435	16,997	4,423	8,702	14,108	14,533	12,732	15,934	1,069,140	..
Grand Total { 1904	94,334	120,379	199,905	245,171	132,795	20,469	12,622	34,303	54,876	70,073	65,882	91,785	..	1,143,993
Calcutta City	221	443	2,053	3,068	1,066	160	50	47	63	29	86	86	7,372	4,689
Bombay City	1,069	2,372	3,072	3,724	2,539	673	191	205	161	79	48	38	14,171	13,504
Madras City	..	4	1	2	7	2	1	..	..	..	..	5	22	8

Table XXXII.—Mortality from Respiratory Diseases.

Provinces, Districts, and Towns.	Bengal.	Eastern Bengal and Assam.	United Provinces.	Punjab.	North-West Frontier Province.	Central Provinces and Berar.	Lower Burma.	Upper Burma.	Madras Presidency.	Bombay Presidency.	Ajmer-Merwara.	Coorg.	Registration India.
I.—Mortality by Provinces:—													
A.—Deaths by months—													
January	—	209	2,392	5,496	51	1,502	309	124	1,918	5,884	48	—	17,933
February	—	140	2,481	5,896	91	1,716	251	100	1,777	5,811	68	2	18,333
March	—	153	2,642	6,346	67	1,388	266	105	1,646	5,396	138	1	18,148
April	—	141	2,577	5,397	93	1,502	223	91	1,511	5,243	89	6	16,873
May	—	122	1,911	5,748	73	1,265	245	98	1,445	4,359	46	4	15,316
June	—	121	1,479	4,709	91	977	321	105	1,471	3,573	22	1	12,870
July	—	102	1,361	4,298	113	847	358	110	1,512	3,460	19	2	12,182
August	—	99	1,491	4,335	92	881	365	128	1,633	3,904	19	3	12,950
September	—	142	1,674	3,900	111	1,113	481	185	1,524	3,928	17	2	13,077
October	—	152	1,521	4,298	88	1,285	426	166	1,723	3,758	20	2	13,439
November	—	170	1,704	5,071	94	1,408	489	205	1,581	4,189	35	1	14,947
December	—	269	2,038	5,869	164	1,513	349	231	1,946	5,032	40	6	17,457
Total	11,189*	1,820	23,271	61,363	1,128	15,397	4,083	1,648	19,687	54,537	561	30	194,714‡
B.—Annual death ratios—													
Ratio per 1,000 of population, 1905.	·22	·06	·49	3·05	0·57	1·30	·73	·56	0·5	2·95	1·18	·17	0·86
Ratio per 1,000 of population, 1904.	·16	†	·41	2·66	0·39	1·28	†	†	0·5	3·22	†	†	†
Difference	+ ·06	†	+ ·08	+ ·39	+0·18	+ ·02	†	†	0·0	− ·27	†	†	†
Mean ratio per 1,000 during 1900–1904.	†	†	†	2·61	0·35	†	†	†	0·3	†	·42	·11	†
Difference	†	†	†	+ ·44	+0·22	†	†	†	+0·2	†	+ ·76	+0·06	†
II.—District mortality, excluding towns:—													
Number of districts affected	30	22	48	29	5	23	17	11	21	24	12	1	243
Highest district ratio	1·32	·94	5·25	11·68	0·69	4·23	·93	·74	1·2	9·86	2·12	·13	11·68
Name of that district	Patna	Lakhimpore.	Hamirpore.	Gurdaspore.	Dera-Ismail-Khan.	Buldana	Henzada	Lower Chindwan.	Cuddapah.	Kaira	Pohkar	Yedenalknad.	Gurdaspore.
Lowest district ratio	·001	·002	·01	0·12	0·09	0·08	·01	·02	0·002	·03	·04	—	0·001
Name of that district	Purnea	Chittagong.	Basti	Multan	Kohat.	Narsinghpore.	Amherst	Kyaukse	Nellore	Upper Sind Frontier.	Beawar Rural District.	—	Purnea
Number of districts without mortality.	1	None	None	None	None	None	1	None	1	None	5	4	12
District death-rate per 1,000 of population.	·12	·05	·26	2·69	0·29	1·16	·42	·22	0·4	2·19	·29	·03	0·64
III.—Town mortality:—													
Number of towns affected	63	23	99	144	10	76	23	5	162	59	4	2	670
Highest town ratio	4·68	1·60	19·02	16·28	4·86	8·30	10·80	15·63	6·6	16·30	5·79	4·67	19·02
Name of that town	Calcutta	Malda	Benares	Narowal	Peshawar.	Balapur	Toungoo	Monywa	Vallam	Jambusa	Ajmer Suburb.	Virajendrapet.	Benares
Lowest town ratio	·02	·05	·02	0·12	0·19	0·08	·08	·83	0·1	·09	·23	·74	·02
Name of that town	Serampore.	Comilla	Ghazipore.	Pindigheb.	Lakki	Hinganghat.	Akyab	Sagaing	Ambur	Karad	Pisangan Town.	Mercara	Ghazipur
Number of towns without mortality.	64	31	8	1	None	23	16	7	70	4	2	3	229
Town death-rate per 1,000 of population.	1·62	·22	3·44	6·30	3·65	2·52	2·91	3·63	1·3	8·03	3·55	1·64	3·35

* Distribution by months not available. † Not available. ‡ Including 11,189 deaths in Bengal, of which the monthly distribution is not given.

TABLE XXXIII.—GENERAL POPULATION.—VACCINATION.

A. TOTAL PRIMARY AND RE-VACCINATIONS, SUCCESSFUL CASES AMONG THE CHILDREN, COST OF THE SPECIAL VACCINATION DEPARTMENT, &C., DURING THE OFFICIAL YEAR 1905-06.

PROVINCE.	NUMBER OF PERSONS VACCINATED BY THE SPECIAL AND DISPENSARY STAFFS COMBINED.		PERCENTAGE OF SUCCESSFUL CASES* TO TOTAL OPERATIONS.		NUMBER OF CHILDREN SUCCESSFULLY VACCINATED BY THE SPECIAL AND DISPENSARY STAFFS COMBINED.		Average number of operations performed by each vaccinator of the Special Staff.	Total cost of the Special Department.	Average cost of each successful case vaccinated by the Special Department.
	Primary.	Re-vaccinations.	Primary.	Re-vaccinations.	Under one year.	1 to 6 years.			
								Rs.	Rs. A. P.
Bengal	1,904,625	136,605	99·13	66·29	809,606	973,461	1,031	1,57,803	0 1 3
Eastern Bengal and Assam ...	1,385,538	43,488	98·28	71·71	414,109	804,891	1,110	80,103	0 0 11
United Provinces of Agra and Oudh.	1,599,905	95,511	97·93	84·78	950,885	532,398	1,850	1,53,241	0 1 6
Punjab	638,310	110,429	99·19	83·38	507,638	103,636	2,810	97,702	0 2 3
North-West Frontier Province ...	87,771	13,095	98·56	84·45	49,320	23,224	3,162	11,644	0 2 0
Central Provinces and Berar ...	551,140	74,998	98·59	72·30	418,160	109,918	2,089	66,368	0 1 11
Madras Presidency	1,357,745	107,245	92·67	76·02	462,317	611,548	†1,660	2,94,419	0 3 8
Coorg	9,306	1,985	93·21	76·26	844	5,150	1,208	2,740	0 4 6
Bombay Presidency	610,985	45,353	97·56	76·13	448,654	99,951	1,522	3,01,303	0 8 3
Burma	426,935	61,992	90·80	53·33	89,131	208,026	1,956	1,14,464	0 4 9
Ajmer-Merwara	14,510	425	95·50	81·65	11,303	2,726	996	2,849	0 3 1
TOTAL ...	8,586,770	691,126	97·20	74·20	4,161,967	3,474,929	1,480	1,282,636	0 2 5

* Excluding those the results of which were not known.
† Excludes average of work done by each medical subordinate.

B. VACCINATION OPERATIONS PERFORMED BY THE SPECIAL AND DISPENSARY ESTABLISHMENTS SEPARATELY, DEATHS FROM SMALL-POX, &C., DURING THE OFFICIAL YEAR, 1905-06.

PROVINCE.	Population.	NUMBER OF PERSONS VACCINATED (PRIMARY AND RE-VACCINATIONS COMBINED).			Ratio of successful vaccinations per 1,000 of population.	Percentage of annual estimated births at 40 per 1,000 of population successfully vaccinated.	DEATHS FROM SMALL-POX.*	
		By Special Department.	By Dispensary Staff.	Total.			Number.	Ratio per 1,000 of population.
Bengal	51,656,383	1,919,125	122,105	2,041,230	37·94	39·18	7,213	·14
Eastern Bengal and Assam	30,788,134	1,401,291	27,735	1,429,026	44·86	33·62	4,723	·15
United Provinces of Agra and Oudh ...	47,960,667†	1,694,761	655‡	1,695,416	33·79	49·57	3,272	·07
Punjab	20,293,834	747,337	1,402	748,739	34·31	62·54	4,723	·23
North-West Frontier Province	2,092,713	98,021	2,845§	100,866	44·11	58·92	571	·29
Central Provinces and Berar	13,621,559	597,348	28,790	626,138	44·83	76·75	8,364	·70
Madras Presidency	38,408,531	1,462,890	2,100	1,464,990	33·75	30·09	18,540	·5
Coorg	180,607	10,878	413	11,291	55·45	11·68	132	·73
Bombay Presidency	21,438,769	652,469	3,869	656,338	27·35	52·32	16,985	·92
Burma	10,477,508	471,420	17,507	488,927	37·84	21·27	6,161	·73
Ajmer-Merwara	476,912	14,935	—	14,935	30·63	59·25	277	·58
Total ...	237,395,617	9,070,475	207,421	9,277,896	36·39	43·83	70,962	·31

* For the Calendar year.
† Includes 16,010 persons enumerated at the Ajodhya fair.
‡ No special vaccinators are attached to dispensaries. Operations performed by Medical Subordinates.
§ There were no special vaccinators attached to the dispensaries. Operations were performed by Civil Surgeons and Medical Subordinates.

ROYAL ASIATIC SOCIETY LIBRARY

00134529

Digitized with financial assistance from

Government of Maharashtra

on 01 February, 2020